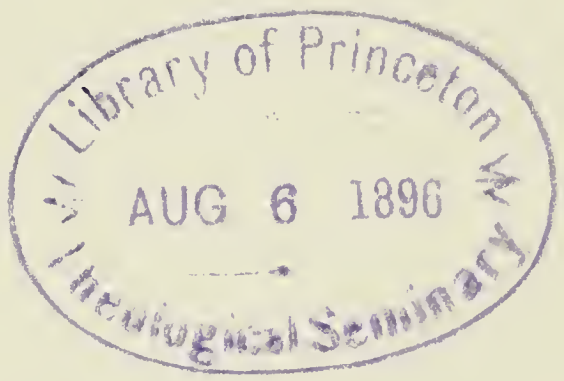

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Studies in Theology.—IV

CREATION

GOD IN TIME AND SPACE

BY

RANDOLPH S. FOSTER, D.D., LL.D.

A Bishop of the Methodist Episcopal Church

ΠΡΟΣ ΤΟ ΦΩΣ

NEW YORK: HUNT & EATON
CINCINNATI: CRANSTON & CURTS

Composition, electrotyping,
printing, and binding by
HUNT & EATON,
150 Fifth Ave., New York.

PREFACE.

The discussions conducted in the following pages are designed to be of interest and profit to all thoughtful readers, and not simply to those who are engaged in theological studies or more general scientific investigations.

The treatise is a popular putting of scientific results rather than processes and methods. As nearly as possible it is a comprehensive view of the universe in its known facts and laws as it protends in time and space. Whoever, whether learned or unlearned, is interested in the pursuit of such knowledge will find here a profitable and fascinating study. As he turns page after page, and the marvels of the universe and the story of its unfolding passes before him, he cannot fail to be entranced and lifted. He will find himself encompassed with realities which, filling him with wonder, will also transfigure him and clothe all being, himself with the rest, with a new significance. The style is, of purpose, popular. No reader will find himself troubled to understand any sentence, even where the subject is obscure.

The treatise popular.

All great facts are great thoughts of God. The facts here given are the greatest known to man—the most certain and, in some respects, highest revelation God has made of himself. Revelation supplements creation with more definite information with respect to his moral administration over men and other intelligences, but in the visible realm he is seen most manifestly in the greatness and glory of his perfections.

Great facts great thoughts of God.

This treatise is designed to serve as a text to the discussion to follow on "The Nature and Attributes of the Supreme Being," furnishing as it does the grounds for rational induction of these profoundly mysterious themes.

It must not be classed among the treatises which attempt a reconciliation between the ascertained facts of science and religion or the teachings, doctrinal or historical, of "holy writ." The facts and the writ, properly interpreted and understood, are in perfect accord. The seeming of contradiction arises from ignorant or perverse interpretation.

Ascertained facts.

The object here proposed is to set forth the ascertained facts without reference to their bearings on any doctrinal teachings of any book or school of thought. Facts must dominate any system, come from what source it may. This is an inevitable law. The first and last demand of mind is truth, which is but another name for facts, and involved principles, which must always and necessarily be harmonious. There is no contradiction between truths, and no demand for reconcilement. They must be accepted, no difference what goes down.

When ascertained one set of facts or one truth may shed a light which will put to flight preconceived notions, but will not, cannot, discredit other truths, but, on the contrary, must aid to a better interpretation and understanding of them, so far as they are affected at all.

Special benefit to ministers.

We solicit ministers especially to the reading of these pages. The benefits to be derived are various. It will take them out of their accustomed ruts into new departments of knowledge and thought. It will supply them with the richest illustrations of the great themes which they are to elucidate and unfold. It will impart zest and variety to their ministrations. It will broaden their view of the

divine method and operations. It will put them in possession of the highest proofs of the infinite greatness of the almighty Being whose servants they are. It will enable them to meet the demands of the hungry and often distracted people to whom they preach, and will save them from the crudities into which all must fall who are uninformed on points which more and more engage educated thought. The knowledge of the great facts of being which scientific research is developing is indispensable to one who would hold the attention of the age and command its respect.

Helpfulness to ministers.

The theology that will live and which can never die is that which will harmonize with the facts of the universe. They must be sought and known, and the theological professor and preacher must show himself acquainted with the facts and be competent to show that his teachings do not require that they should be ignored. He must recognize them and deal with them. He may not be required to preach science from the pulpit or to become a lecturer in science, but he must know the facts, and not preach or teach doctrines which collide with them. More than that, in the tumult of thought which every new discovery creates, and amid the roar and clamor which is ever and anon raised against popular theological beliefs and teachings, he must be able to satisfy himself first, and then the people to whom he speaks with pen or tongue, that, while some long-regnant ideas may require to be abandoned as rubbish of ignorance, the citadel remains intact.

Theology that will live.

The strength of any system is the truth which it holds; its weakness is the errors which infest it. If it is all error it is utterly worthless and harmful. If it has some errors of incidents and minor points they may be relinquished without harm, and its power thereby be increased. If its errors are shown to be not inherent, but the accidents of misinterpretation merely, it is made stronger by the exposure

Strength of a system.

if its expounders and defenders show themselves pleased with the discovery and glad to amend the mistake. Nothing can save a system which shrinks from investigation, or attempts to build itself on ignorance, or the impudent denial of facts, or refusal to know them, or inability to show that it does not contradict them.

In the interest of theology we plead for the freest and largest liberty. We hail every new discovery. Every new truth, no difference what old error or system of error it may shake down and utterly destroy, is a harbinger of the millennium.

The word *Creation*, which stands as principal in the title of this volume, is used in its proper sense as a noun, and is the equivalent of all things that exist—the universe. It assumes that all of whatever exists is product of creative energy except the energy, or source of the energy, which creates, and which is necessarily eternal.

The further words of the title, to wit, *God in Time and Space*, are designed to imply that all created existence is product of divine energy exerted in a progressive method and continuous forthputting of power to fill out the measure of infinite thought.

The object of the discussion is to show the vastness of creation in its space and time measures, and its method of advance from the incipient material atom to the topmost result of spiritual existence, from chaos to cosmos, from the inorganic to the organic, and from the organic to the superorganic, and from the superorganic, or merely sentient, to the higher superorganic or spiritual realm.

The inorganic and organic, both insensate and sensate, are assumed to be primary stages, or platforms, which have their meaning in a service they render to the final outcome of a spiritual and immortal universe.

The author aims to show that there is a difference between the inorganic and merely organic realms which requires specific energizings of the divine Author equivalent to diverse creative acts, and that the same is true between the insensate, or vegetable creation, and the sensate, or animal creation; and that the same is true, also, between the sentient, or merely animal, and the rational and higher spiritual forms of life.

Man is shown to be the final product, and the most recent in the time order of existence, and the final cause, or end of the entire creative movement, whose advent explains and puts meaning in all the antecedent stages of the creative drama.

It is shown, not merely, that man is the most recent member of the series, but more than that, that his advent is *very recent*, at furthest not more than eight or ten thousand years ago, while all other known living beings date back perhaps hundreds of thousands of years.

The several theories of a more ancient humanity, possibly of inferior qualities and type, and of plurality of origin, are examined and shown to be without evidence to support them. All the evidence points to one head of all the ethnic varieties, and that head the Adam of revelation.

Finally, it is assumed as probable, but as unproven by any facts within our knowledge, that the universe is peopled by numerous intelligences of various grades of power and glory, some of whom are superior to man, perhaps, in age and perfection, others possibly as recent.

When we say unproved, we mean that there are no facts within our absolute knowledge to establish the certainty that there are personal beings other than those of our own race and the infinite Author himself, but there are known facts which render the conclusion highly probable, and therefore worthy of faith; indeed, such as render it quite irrational to doubt.

One book whose authority we are compelled (we mean, of course, by stress of evidence) to accept as divine testimony is conclusive. The Bible speaks with no uncertain voice on the subject. We accept without hesitation its testimony.

While the popular but declining doctrine of so-called evolution—the doctrine that one thing is by inhering forces the source and cause of another and succeeding member of the series, and so that all things are traceable to a primitive atom—is discounted as unscientific and impossible, it is shown that there is a true relation between all forms of existence, each antecedent serving as ground and condition of each succeedent—a close consecutive chain running through and binding all together into a complete and united whole. It is shown that this beautiful harmony is brought about, not by the unintelligent working of so-called natural forces, but by a continuous divine energizing in created substances of which each specific force is simply a mode or result, the entire series being thus an absolute effect of the forthputting of divine thought by exercise of divine power.

As the universe itself in all its parts and as a completed whole is a product of divine thought and power, we recognize that all the forces which play in it as causative of the result are simply direct modes of divine energizing, or indirect but purposed and inevitable results of established relations among the things created. Things created do nothing independently of their author.

Man is the only being known to us who by his Creator is endowed with power whereby he becomes the author of his own acts.

The author will have accomplished his highest aim if in the mind of the reader he shall have awakened deeper reverence

for the great Author of the marvelous universe system by placing before him a more adequate view of the mighty work as it extends backward through immeasurable ages, and outward over limited but semi-infinite spaces; and especially if he shall have been able to furnish him a proximately true clew to the method of the great movement from the beginning to the present; and more especially still if he shall have aided him to a discovery of the great end had in view—an end of ineffable love.

We stand in the middle of the process, and with our finite powers we but dimly perceive its meanings, but we see that it has profound meanings, and from the imperfect comprehension we have we are able to discern something of the outcome. Ages yet may be required to unravel all its mysteries, but we cannot doubt that far on its revelations will not only make plain what is now obscure, but will also bring to us new and higher manifestations of the infinite love and wisdom which inspired and directed it from the beginning to the end—nay, to the forever progressing wonder that will have no end.

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THE UNIVERSE.

THE UNIVERSE.

PRELIMINARY OBSERVATIONS.

Earnest minds cannot think of God without a sense of awe; and revelation in so many ways teaches of his greatness that a mind filled with its exalted imagery and august doctrines, even though its conceptions may be vague, must be impressed with a profound sense of his majesty and glory; but reflection and enlarged knowledge of his works cannot fail to give added dignity and substance to his conceptions. The universe of reality will transcend that of imagination—the invisible things of him, even his eternal power and Godhead, here come to light and certainty. Wisdom, power, and majesty gleam from every atom and from every organism. There is nothing any more little or unmeaning, or that does not point to the one all-glorious Founder of the mighty system; nothing that does not tell of his love and create confidence in his goodness and beget faith in the beneficent outcome of his plan, however for the present it may be enveloped in mystery and insoluble perplexities to our finite and limited faculties.

Until recently the universe little known.

For ages—indeed, until recently—but relatively little was accurately known of the universe in any respect, but especially as to its constitution, laws, forces, order of development, and actual history. At last scientific research has replaced the crude conceptions of ignorance and blind imagination with something approximating truth and reality, and bids fair to still further unveil the long-hidden mystery of its beautiful order and harmonies.

The true conception of the universe has such manifold relations to the true knowledge of its Author that in approaching the study of his nature, attributes, and character it will be of profit to us to refresh our minds with a brief survey of it. It must, of course, be brief and suggestive in a treatise like this, and general and popular rather than strictly scientific; but it should be sufficiently comprehensive to bring the universe present to our thought somewhat as it is in reality.

The survey in itself will be profitable without reference to anything ulterior; it is tonicful and broadening to the faculties to grapple with vast things. The universe is, next to the Infinite as he reveals himself in his word, the best door of approach to him. To what is to follow it is, if not absolutely indispensable, exceedingly important, and will not fail to be helpful to the reader, to consult the book styled *Cosmic Theism*, in this series.

Point where we enter the universe.

At the point where we enter existence we find ourselves environed by a vast semi-infinite complex of being and change. The objects we behold on every hand differ among themselves in almost infinite variety of form, texture, habit, use, and power. They seem to have relations to each other and a kind of unity. They come and go with variable regularity. Some kinds and groups seem to depend on other kinds and groups. A change here emerges in a change yonder. Gradually it dawns upon us that we are in the midst of a deftly arranged system. The multitude comes to unity, and changes march to the rhythm of a plan. We ultimately discern that, so far from an anarchic mass merely, there is not an atom that is not held to a line by inexorable law. We emerge out of what seemed at first a chaos into a deft and beautiful cosmos. A multiplicity of forces play in and around us, but they are all guided by intelligence, and without excep-

tion work to ends of harmony and beneficence. The reign of law is discovered to be universal.

The discovery of orderly action in the wondrous system immediately gives rise to two questions, namely, Is the observed order from within the system itself, or is it and the system itself superimposed from without? and are we able from the observed operation of forces, or master force exerted and traceable in past and present effects, to discern the trend and probable outcome?

The first of these questions is fully discussed in *Cosmic Theism*,* of this series. The second is in part considered in the same treatise, but will be more fully developed in the present discussion.

The discussion on which this volume enters is logically preliminary to the discussion of the nature, attributes, and character of God.† Recognizing the fact and fundamental principle that the Bible is an authoritative and infallible teacher on these great points, and as such must be court of last resort and final appeal, it is assumed here that for its correct interpretation and understanding the universe must be interrogated and its facts elicited, as illustrative and exponential. Here God is seen in action.

Action better than words.

Action is the deepest revelation of an agent. Better than words, as giving meaning to words, it discloses what in truth the agent is. When the acts are obscure, or but imperfectly apprehended, word statements serve as guides and helps, and when supported by adequate evidence determine the significance of acts themselves, placing them in a clearer light, and leading the weak and vacillating understanding to a discovery of deeper meaning than it, unaided, could reach. Thus revelation usefully supplements manifestations and helps to

* See *Cosmic Theism*, by the author.

† See *Nature and Attributes of God*, by the author.

right understanding. The two never do nor can disagree. Each when properly used is helpful to the other. The knowledge of each, possibly not in the same degree, is essential to the interpretation of the other, or if not absolutely essential is indisputably helpful.

Facts must rule.

In any event, nothing is more certain than that facts of the universe must have an important bearing on the nature and character of its author. For this reason, before entering upon the higher theme which lies more remote from us and in the deepest obscurity, we propose in the present volume to deal with the plainer facts which lie immediately about us.

Facts multitudinous.

The facts of the universe are multitudinous. Some lie upon the surface and are easily discovered; others are concealed in the deepest obscurity and are difficult of discovery, not alone as to their causes and significance, but as to the facts themselves. No telescope has yet measured the vast areas of the system; no microscope has penetrated to its minutest constituents. There are still unexplored realms, in all directions and departments.

The survey we propose is of some of the more conspicuous and significant of the known facts, ascertained, not by casual observation merely, but by the accredited methods and most rigorous tests of science.

System, orderly processes, intelligible sequences, are the manifestations of mind. A thought factor is intuitively discerned in every arranged series. Any force expressed in the series, or necessary to it, points to a personal agent as exerting it—is directly or indirectly personal force.

Canon first.

The canon is, wherever plan or system is discerned as means to ends, and the means are effective to the ends, intelligence is invariably and necessarily precedent, and is efficacious cause of the plan, the force employed, and the out-

come, so that did no such intelligence exist, neither plan, nor force, nor outcome could exist.

There must be, as antecedent, the personal planner in order to the plan. The planner must exert the force or employ it masterfully in order to the end. The outcome shows first of all the planner; then the intelligent purpose; then the force exerted to effect it. This relation is absolute and necessary. This is but another form of the maxim, "There can be no effect, which means change of any kind, without a cause." This is a universal canon. The effect in the case supposed is not merely an effect of force resulting in a change of some kind, but of a force exerted or controlled by intelligence in order to a preconceived end, and therefore a force which requires a personal agent. If we could suppose the intelligence in the agent withdrawn the effect could not take place; the force, in fact, could not exist.

Every natural force which we call a law is itself invisible, the idea of it in the mind arising, by way of necessary inference, out of an observed order of facts. And very often, if not always, in our conception of these forces we are investing them with the attributes of intelligence and of will, at the very moment, perhaps, when we are stumbling over the difficulty of seeing in them the experiments of a mind which is intelligent and of a will which is supreme. The deeper we go in science, the more certain it becomes that all the realities of nature are in the region of the invisible, so that the saying is literally and not merely figuratively true that the things which are seen are temporal, and it is only the things which are not seen that are eternal. For instance, we never see the phenomenon of life disassociated from organization. Yet the profoundest physiologists have come to the conclusion that organization is not the cause of life, but, on the contrary, that life is the cause of organization; life being something—a force of some kind, by whatever name we may call it—which

Natural forces.

precedes organization, and fashions and builds it up. This was the conclusion come to by the great anatomist Hunter, and it is the conclusion indorsed in our own day by such men as Dr. Carpenter and Professor Huxley, men whose philosophy certainly has no bias toward either theological or metaphysical explanations, or toward belief in anything which cannot be seen and weighed and handled.

But what is vital force. It is something which we cannot see, but of whose existence we are as certain as we are of its visible effects—nay, which our reason tells us precedes and is superior to these. We often speak of material forces, as if we could identify any kind of force with matter. But this is only one of the many ambiguities of language. All that we mean by a material force is a force which acts upon matter, and produces in matter its own appropriate effects. We must go a step further, therefore, and ask ourselves, What is force? What is our conception of it? What view can we form, for example, of the real nature of that force, the measure of whose operation has been so exactly ascertained, the force of gravitation? It is invisible, imponderable. All our words for it are but circumlocutions to express its phenomena or effects.

There are many kinds of force in nature—which we distinguish after the same fashion—according to their effects or according to the forms of matter in which they become cognizable to us. But if we trace all our conceptions on the nature of force to their fountain head, we shall find that they are formed on our own consciousness of living effect—of that force which has its seat in our own vitality, and especially with that kind of it which can be called forth at the bidding of the will. If we can ever know anything of the nature of any force, it ought to be of this one. And yet the fact is that we know nothing. If then we know nothing of that kind of force which is so near us, and with which our own intelligence is in such close

alliance, much less can we know the ultimate nature of force in its other forms. It is important to dwell on this, because both the aversion with which some men regard the idea of the reign of law, and the triumph with which some others hail it, are founded on a notion that when we have traced any given phenomena to what are called natural forces we have traced them further than we really have. We know nothing of the ultimate nature or of the ultimate seat of force. Science, in the modern doctrine of the conservation of energy and the convertibility of forces, is already getting something like a firm hold of the idea that all kinds of force are but forms or manifestations of some one central force issuing from some one fountain head of power. Sir John Herschel has not hesitated to say that "it is but reasonable to regard the force of gravitation as the direct or indirect result of a Consciousness or a Will existing somewhere." And even if we cannot certainly identify force in all its forms with the direct energies of an omnipotent and all-pervading will, it is at least in the highest degree unphilosophical to assume the contrary—to speak or to think as if the forces of nature were either independent of, or ever separate from, the Creator's power.

Outlines of astronomy.

It follows, then, from these considerations, that whatever difficulty there may be in conceiving of a will not exerted by a visible person is a difficulty which cannot be evaded by arresting our conceptions at the point at which they have arrived in forming the idea of laws or forces. That idea is itself made up out of elements derived from our own consciousness of personality. This fact is seen by men who do not see the interpretation of it. They denounce as a superstition the idea of any personal will separable from the forces which work in nature. They say that this idea is a mere projection of our own personality into the world beyond—the shadow of our own form cast upon the ground on which we look. And, indeed, this in

a sense is true. It is perfectly true that the mind does recognize in nature a reflection of itself. But if this be a deception, it is a deception which is not derived by transferring the idea of personality to the abstract idea of force, or by investing combinations of force with the attributes of mind. *

Personal cause necessary.

The most stringent advocates of naturalism cannot free themselves of personal cause without assumptions and presumptions so violent as to shock their own intelligence. The necessity which compels us to impute mind where we behold an orderly arrangement is in the nature of mind—it is universal, it is irresistible. If the order is discovered in the arrangement of the parts of unliving matter we spontaneously say, Who did it? or, What is it for? or, How ingenious it is! If it is a thing of life we instinctively attribute intelligence to the source of life, in whatever form the life appears. This spontaneous conclusion is supported when we submit the subject to reflection. It is impossible for us to reason ourselves into the belief that the orderly arrangements of nature are the issues of chance. Nor do we find content when we attempt to conceive that somehow nature built itself by blind forces. We cannot rest until we impute personality to the cause. It is forced upon us that there was and is *a* mind back of all. It holds us with the unrelaxing grip of a necessary truth, that the force which projects order is an *ordering* and *arranging* agent or personal being. When we translate nature from within we find three facts always in our consciousness. They are these: first, we consciously feel that we have power and exert it volitionally; second, when we consciously exert force which issues in orderly arrangement we know that a mental process precedes volitional activity; third, we know that when arrange-

Chance impossible.

Mind back of all.

Consciousness in relation to power.

* *Reign of Law*, pp. 119–121.

ment emerges in an orderly way the order was enforced from without, under conditions of thought and will. We infer, and the inference is a necessity of thought, that the same must be true in every like case of orderly arrangement. If now we locate the arranging forces in matter we do not get rid of this law. We must still posit a thinking and volitionating agent in order to the result. And if we find, as we do, nature constituting one ineffable, all-inclusive system, we are compelled to posit one all-embracing force, exerted by one thought and will factor. That force, be it what it may and wheresoever located, requires infinite intelligence and omnipotence as its source. If we locate it in matter we simply impute personality to matter and clothe it with infinite attributes, thus transforming it into God. But this idea is beset with so many violent presumptions against it that reason at once and unalterably rejects it. We are driven by stress of necessity to seek the home of the agent manifesting itself in some extra immaterial being. There is no respectable thinker who any more doubts the presence and operation of personal agency in the universe. Spirit is recognized as a substance different from matter, and possessed of the very attributes of thought and intelligence manifested in matter.

It is of the essence of effects that they should have a beginning; and, therefore, that there should be a time when all effects were nonexistent. It is of the essence of cause that it should be existent in order to the effect of which it is cause. Ultimate cause must therefore be antecedent to all beginnings, and must therefore be itself unbegun, self-existent and eternal. No effect can have anything which was not imparted by its cause; therefore the aggregate of effects can possess nothing which was not imparted by the ultimate cause. The forces which are operative in the universe are therefore derived from, or manifestation of, the one original

Effects must have beginning.

Ultimate cause eternal.

force factor—are but forms of his direct agency, and can in no case transcend what he puts in them. All of which again is but the maxim, "Every effect must have a cause." It thus appears not only that the determinative factor in the universe is mind, but that all forces emanate from the ultimate intelligent cause. For our purpose it is not necessary to enter further into the argument.

TO FIND THE METHOD OF THE ETERNAL CAUSE.

STARTING with this postulate, our aim is to find whether we can so put ourselves into relations with the eternal Cause as to discover his plan and method, and the ultimate end and outcome of his personal activity.

There are two ways by which mind communicates with mind, whereby one mind detects the existence of other mind, and becomes aware of its methods and aims. Mind itself is invisible. We can neither see it nor see its act. This is true both of internal and external seeing. The mind does not perceive other mind or other mind acting, except as results occur. The results are what are seen, and the cause is seen in them and not apart from them. If we were dependent on direct perception it would elude us entirely. Mind *manifests* itself in words and acts, and in no case discovers itself directly. We can only know that it is, and what are its thoughts, feelings, purposes, and plans, by some word revelation of itself, or by some external act which it causes. Even the consciousness of itself emerges only when it is active.

Two ways of discovering mind.

The Infinite must possess methods of communication peculiar to himself. Finite mind reads mind only through symbols. It has no power to intuit other minds—to gaze on them in their pure subjectivity—to read their quiescent states; indeed, it can only know itself in action. The Infinite may—nay, must—have a power to read the inward states of mind without the outward symbol, and may have the power to communicate with and awaken and guide the thought powers of finite minds without the aid of external phenomenal manifestations.

Difference between the Infinite and the finite.

Language a means.

The two methods, or ways, rather, in which finite mind is able to detect the existence of and become communicant with other minds are: First, by means of words, spoken or written. Spoken words are sounds addressed to the ear. Written words are characters or forms addressed to the eye. To these, as of the same kind, may be added motion signs, addressed to the eye or touch. In order to the use of this method the communicant minds must be so posited as to employ these symbols; that is, must be invested with some kind of sensorium. There must also be a community in the signs employed. Each mind must attach the same meaning to, or must invest the same mentality in, the symbol, before one can translate the other. These signs, in fact, are mutual formal thoughts, so that in employing them each discloses to the other that he has the same thought. The language symbol may be an impartation to both, or a creation by both.

Language both a gift and an invention.

The *power* of language—*varied mental vocalization*, as evinced by man—is a *special* endowment conferred in creation, differing in scope and quality from the inarticulate sounds of inferior living creatures—an instrument intended for the use of mind and bestowed with the gift of intelligence. It is a spontaneity of mind, but there can be little doubt that in *quantum sufficit* for immediate use it was conferred at the beginning. But language is also a growth, keeping pace with mental development—an instrument first existing *in posse* in the human mind and organs, and emerging into reality as needs demand. It is an elaboration of human skill, ever increasing, ever growing in compass, definiteness, and perfection, but as yet inadequate to the perfect expression of all mental states, needs, and wants. So far forth as the vocal or written symbol is definite and comprehensive and significant of the same thing to the various minds employing it, it serves

as means of communication between them. That it may be the servitor of truth it must have breadth, delicacy, flexibility, fixedness, and the communicant minds must be able to know that the meanings they attach are identical. An unknown word conveys no idea, or misleads and confuses. Developed language is the indispensable medium of *accurate* thought with reference to things which lie outside of immediate perception, and, indeed, must with relation to all matters of thought be forever the *chief* means of mind communicating with mind. Bereft of the service of a common language, it would be impossible for minds to compare their perceptions, and more impossible still to communicate to each other their reflective processes and rational conclusions. Language is not only the creation of mind for the purpose of expressing itself, but it is the conservator of thought, the medium of treasuring it up in imperishable forms. Without it there could be no growth of knowledge, or relatively but little. The whole inner world of consciousness would forever remain expressionless. So the Infinite, when he created minds, endowed them with the versatile power of language, both that he might communicate with them and that they might be possessed of a common medium of intercommunication among themselves, and that they might hold in permanence and make common all acquired knowledge. But for this endowment it is difficult to conceive how the intelligence of man could greatly have transcended that of the brute creation. Even brute life is endowed with a measure of mentality and corresponding linguistic capacity, by which adequate power of correspondence between individuals may be maintained and the ends of existence be secured. With man the endowment is large, in proportion to the demands of the higher range of his faculties and requirements of his more profound and varied wants and experiences. Thus mind is able to communicate

Requisites of language as a medium of communication.

with mind not simply with respect to the objectives of sense—external material forms and their qualities—but also with respect to whatever is held in consciousness—thoughts, feeling, motives, purposes, principles of action, emotions, volitions, and whatever else characterizes mental and ethical states and activities.

Acts as a means of conveying mental purposes, plans, and ideas.

Second, mind comes to know other mind by means of external acts or results of actions, when these are observed. The proper act of an intelligent being is thought, feeling, and volition, which emerges in some external effort, and thus represents and reproduces itself in the mind of an intelligent observer. When we see the external act, which is all that we can see, we intuit the internal act in its two elements of thought and will, and at the same time cognize the invisible agent. Acts and results of acts are a kind of language the meanings of which we acquire with great facility. As in the case of verbal symbols the medium may not be perfect; no one mind may be able adequately to translate another mind, but the laws of mind are so unique that average mentality will be able to detect the significance of a well-developed series of observed acts.

Require faculty, time, and opportunity.

The interpretation will require faculty, and will depend on sufficient time, breadth, and continuity of observed facts, with close and thoughtful attention. If the acts are obscure or the connections uncertain, involved, conclusions will be correspondingly unreliable; but if the acts be clear and articulate and the opportunity full for a complete examination, and, especially, if they are such that the observing mind can view them in all possible aspects, the interpretation will be proximately certain.

The same intelligent agent may employ both methods or but one, and either one of the two; may put himself in rela-

tions with other minds and unfold himself to them by acting under their observation or by communicating in words, or both. Should he adopt the former method alone, the interpretation would require more labor and might leave greater room for doubt of its meaning. Should he adopt the latter alone, the information might be more exact, but it might leave greater room for suspicion as to its truth. Should he adopt both, truth would require that there should be perfect harmony between them, and content to the observing mind would require that the harmony should be apparent, or at least that there should be no appearances of irreconcilable contradiction. When practicable the greatest accuracy and the most perfect content would be attained by the combination of both methods. The word explanation might suggest some things which the most careful and able observer would not detect from the act alone; might relieve points of obscurity by giving the clew; might save expenditure of time and force by immediate revelation, and in many other ways might be beneficial.

The same agent may employ both methods.

Relations of each.

We have the clear conviction that the great Mind discoverable in the universe has added a word explanation to a work manifestation, and we cannot doubt that it has in many ways brought us to a clearer and more perfect understanding of his thought and purpose in the things that are seen.

God has employed both.

The scientific spirit which has come to such prominence today owes its existence to the progress which revelation inaugurated and brought forward; and the discoveries it has made, and will make with accelerated rapidity, are the indirect product of the right direction and great quickening revelation has given to human faculties and inquiries. Among the most beneficent results is the mental enlargement it has produced. This is a fact which all well-informed and great-minded inquirers gratefully acknowledge. But, on the other hand, the

most devout and reverent Christians must admit that there is an open door for scientific inquiry, and must rejoice in any aid to a better understanding of nature which it may furnish, and thus lead to a better understanding of the work. Written language gives permanence to ideas and knowledge gained, and so is the conservator of growth and progress.

The present discussion which it proposes.

The present discussion is partly scientific, partly philosophico-theological. It undertakes to present, from known scientific data and principles of philosophy, a view of the world-plan, or method and purposes of the infinite in creation, deduced from grounds largely outside of revelation. The object is not to establish a harmony between the teachings of nature, scientifically and philosophically interpreted, and revelation, but to present a rational view of the divine movement from the inception to the outcome of his work by a study of the works themselves. Occasional biblical facts will emerge, and it is believed the result of the inquiry will show that a rational theory will be in substantial accord with the word God has given, properly interpreted.

CANON.

In case of seeming collision.

It must be admitted that in case of collision an ascertained fact must always prevail against a word statement, no matter how supported. A word statement can never have proof that it emanates from the infinite Mind which founded nature as strong as the proof is that nature is his work. And no teaching of the word, if it does emanate from him, can contradict his own act. In case of a certain contradiction the assumed word must go down. We believe this is a true principle, and must at any risk be followed. But the proof that a word communication is direct may be so great as to be inevitable to reason on any other

Relative value of word and act.

ground than that of absolute contradiction; and in the case of a word which unmistakably contains a prophecy, in the best sense, or that is backed by miracle, if such a case can be shown, the proof that it is of God is precisely of the same kind as that nature is from him, and is entitled to the same right, and in such a case contradiction is impossible, but it would require that the miracle and prophecy be real, and not supposable merely.

The only difference in that case between the authority of the word and the work would arise from the different degrees of certainty that we are not imposed on by appearances on the one side or the other. But the probability of deception in the case of a miracle or prophecy might be always greater than in that of a fact of nature; and in case of an apparent conflict reason would so decide. But it should be remembered, in trying the case, that mere difference is not contradiction or conflict. A word communication may add something not contained in a work manifestation, and the absence of it in the former case would not disprove the truth of the word. There may be thoughts and purposes in the infinite which are not expressed in mere nature, and which could never be deduced from any known facts or principles. A revelation containing an account of such could not be discredited by the mere paucity of nature. It might even reasonably be presumed that in matters of morals, where great interests are involved, and where reason, by reason of its slowness of action and the paucity of data, might prove an insufficient guide direct information would be imparted. It could only be demanded, in such a case, that suitable evidence should be furnished.

Relative spheres.

These are principles which every candid truth seeker should keep in mind; and, properly observed, they will save us from discarding the aids of a word communication too hastily, and from accepting it too indifferently or im-

Principles to be kept in mind.

perfectly; and also from relying too exclusively on the teachings of nature in all matters. They may properly leave science supreme in relation to some things, making it useful in correcting any vagaries and dreams which we have hastily attributed to revelation, and the word be left supreme in another realm which mere science cannot reach. No fact of nature can furnish *prima facie* evidence against the possible and actual fact of a revelation, and no assumed revelation can discredit any fact of nature or limit the right of inquiry.

Science supreme in some cases.

The most casual observer will directly perceive three lines of movement going on or being carried forward in the universe.

Three lines of divine movement.

The three lines of movement are: (*a*) the processes going forward in inorganic matter—azoic, particles and masses; (*b*) processes of life in all varieties; (*c*) processes in the realm of mind or spirit. Throughout the movements are incessant and correlated, but always differentiable in law and method.

We shall observe to little effect if we do not soon perceive that in each department there is at least one common characteristic, that of a progressive and well articulated unfolding from seemingly insignificant beginnings to grand and imposing outcomes. Nothing begins at perfection: first rudiments or germs, then advance by process to culminations; each culmination serving but as fulcrum for some grander advance; the entire evolution revealing the matchless skill and inexhaustible resources of the mighty worker, and the inconceivable and endless richness of his design.

A common characteristic.

In the first realm, the inorganic, the agent moves along the line of his advance by simple efflux of volitional force, guided by unerring skill, but even here never to the end *per saltum*, but in the use of well-adjusted means

The inorganic realm.

raised into second causes. But whether the end be reached by immediate creation or by mechanical approaches and long-drawn processes and indirections, in either case and alike his personal agency is sole cause, and may be traced by the studious observer along the entire line, however it extends in time and space.

The organic realm.

In the second realm, the department of life, it is the same agent, but working in a different way. The results and laws of the older processes are taken up and subordinated to higher ends. Germ centers are created, and constituted fulcra of a unique and previously unknown form of force which, under guidance of infinite skill, evolves an endless variety of living organisms, which sustain various relations to each other and to all inorganic existence in a multiform and beneficent economy called life. Here again he is sole agent, and the entire manifestation is manifestation of his power, wisdom, and beneficence. As in the former case, the movement is continuous and progressive, passing in vast measures of time from the lowest to the highest forms, each taking up the inferior result already reached and advancing to a nobler type.

The realm of mind.

A free force.

In the third and crowning realm progress is again the law, but it is now a progress of the free individual along an endless line of possible improvement and perfection. The grade of being is different in essence and attribute. It is invested with new qualities and dignities, and the law of its development is different and exceptional. The creative purpose is indicated in its constitution and asserted in its consciousness, but its attainment of its end is not enforced, as in every other case, from without, but is committed to its own personality, and depends upon a free power *ab intra*. Here we encounter for the first time the presence of a force that is independent and free in its action.

We rise into the region of proper agency: though created, a realm which is not under the divine force, but which is free under the restraints of law—a moral realm.

Agency always invisible—consequent difficulty.

To be able to deduce the purpose, method, and outcome of this triune movement of a strictly invisible agent, with the obscurities which necessarily surround it, must, confessedly, be extremely difficult. The data must be gathered from a wide field, both of time and space, and used with caution and care. Were we doomed to attempt the work single-handed, nothing could be more hopeless. The speck of time and limited space given to any individual observer, with the small power possessed by any one human mind, would render the task not simply hopeless, but absolutely impossible, and brand the attempt as the grossest folly and presumption.

Demands of a clew.

A clew to a mental movement, from observation, requires that a sufficient part of the evolution should be observed, not in isolated fragments, but in connection and relation. Then it is not impossible or even difficult. Once in the line we detect the meaning of each consecutive act, and forecast with ease the next step, and see on to the end. There is so much homogeneity in rational action that our mind reads not only what has been written, but on beyond, the lines that remain to be filled out.

An illustration.

In the city where we dwell, some morning, we hear the heavy tread of passing feet. Looking up we find it is a gang of workingmen going on to their toil. Our curiosity is excited, and we follow them to learn what it means. On closer observation we find that some are supplied with spades, others with picks, crowbars, drills, and powder cans. From the merest glance at the equipments we at once know this means excavation of some kind for some purpose; we cannot tell yet what. Now they come to a halt, adjust themselves, and one begins to strike into the earth with a pick, another to

remove the loosened parts, another drills a hole in the rock; already it is apparent *what the implements are for*. The work progresses; a great hole is made in the earth, and the rocks and soil removed to convenient points of deposit. The sides of the excavation are trimmed to a line, and the angles are fixed. The blasted rock and other stone have been corded around the edges. Now new workmen appear with trowels, hammers, plummets, and other tools used in masonry. We now know that all this means a structure of some kind. Different kinds of dressed and undressed material are gathered. The foundations are laid, and the walls begin to go up—cross walls and openings. Long before the completion we are able to determine what the finished structure is to be and to what end it is built. The series of observed facts show the plan and proclaim the design. Simply looking at these we find what was in the mind of the worker at the start, and in what manner he chose to accomplish his purpose. We need no word statement in the presence of such facts, and any word statement could only conform to the facts. The act series is simply a thought series which emerges anew in the mind of the beholder.

The trend—how obtained.

It is obvious that in order to translate the act series back to the thought series there must be homogeneity between the worker and the observer. There must also be enough facts of the series drawn out and observed in their exact order to constitute a trend. These conditions being fulfilled, the induction is likely to be proximately correct, and will not fail to be correct in its general character. The act series will emerge in a thought series as surely as it emerged from a thought series.

It matters nothing that the act series is from the infinite, and that the observer and interpreter is finite. The finite may not comprehend either the plan or the method of the infinite as the infinite himself comprehends it; but an act series of the

infinite may translate the thought series which it represents to the finite in a degree. The finite will see and think the thoughts of the infinite so far forth, though he may not comprehend the whole. Though we do not rise to the height of the design or fully comprehend any part of it, and though the working of the power be complete and absolute mystery to us, we may be able to get the trend of the vast movement to its utmost outcome. "Parts of his ways" we shall see though the greatness will transcend us; "the remainder will be past finding out." It is a great undertaking "by searching" to find out God. It is hopeless to attempt to know him to perfection; but is it impious to hope that by diligent study we may at least learn something of his ineffable character and inscrutable plan?

The same whether the agent be finite or infinite.

May not comprehend in full.

The disadvantages are confessedly great. The worker, as to essence of being, is absolutely unapproachable by us in any way. He hides himself behind an impenetrable veil. He is incomprehensible in character, and modes both of being and action. In some way and for some reason, out over immeasurable areas of time and space he sends signs of his existence. The field is so vast, and life is so short and our standpoint so narrow, that we can only see a small part of these signals, and over all a vast obscurity hangs. From these insignificant atomic facts we are to undertake to interpret him. Necessarily much will be meaningless to faculties which cannot grasp the whole, and where obscurity is so profound some obscure facts will even be misleading. Can we find a clew? Can we by any possibility get the line?

Disadvantages.

Vastness of the field.

There are these encouraging circumstances with relation to the matter in hand which we do well to note: If the case is beset with obscurity the obscurity is not so dense as it once was. We stand far along the line of the movement. The plan is far advanced in its development, and

Encouraging circumstances.

a clew has been discovered. Multitudes of skillful workers have preceded us and furnish ready to our use a great accumulation of materials. Their combined researches extend over centuries of time and cover a large part of the field of observation. We but construct out of the materials they have gathered and sorted to our hands. In fact, they have laid the foundations and we but continue the walls which they have reared so well. The amount of patient work already done—quarrying in the earth, quarrying in the stars, quarrying in the mines of thought, blasting a way through the dense darkness of ignorance and the thick walls of prejudice and superstition; work through midnight vigils; work with feeble bodies and overtaxed brains; work many times with no recompense but derision; work for the love of truth; work that now enriches the world and will continue more and more to fertilize coming ages—passes all estimation. It is thus by combined toil of noble minds the structure of knowledge is built.

[Work done.

Mere casual sense observation gives the fact of a great mass of inorganic existence, which in itself, merely as observed, suggests nothing of a temporal order; nothing of an historic process; nothing of changes, methodical or unmethodical, that have passed within or before it; nothing, in fact, but present existence and speculations. If we would know more we must linger and take note.

Material existence merely as observed gives nothing of temporal order.

That there is a temporal order we learn by research and experience. By closer and continued observation we find an ongoing in ourselves and in things—markde by sunrisings and sunsettings—by the succession of the seasons; by growth and decay; by birth and death; by that change which passes on things. *The world*, to casual observation, seems to be permanent and abiding. That it also had a birth

Temporal order—how ascertained.

and history, and that there was any possibility of ascertaining the date of the one and tracing the events of the other, was not even surmised by the coming and vanishing generations of men that dwelt upon its surface. Whether it was young or old none could tell. Tradition made it young.

Earth records.

But it has *now* become well known that there were processes going on from the beginning within the earth itself which were recording its marvelous history and laying it away in the rocks forever. We have at last become aware of the processes, and have learned to translate the record with more or less accuracy. We know that any series must have a beginning and a history connecting the whole. Having found the clew, we are able to trace the successive changes to the primal movement; and to pass beyond that to the eternal agent which gave it its start, and by successive effects to determine what kind of a being the agent was and is.

Three things discovered.

From the study of these well-preserved records three things force themselves upon us as absolute certainties: (*a*) that the system had a beginning; (*b*) the lapse of almost immeasurable time since its origination; (*c*) the constantly advancing dignity and worthiness of its ends and uses.

The first of these assumed certainties encounters objection on so-called scientific grounds; the second was long resisted by popular prejudice; the third is in one form or another admitted by all.

The system had a beginning.

That the system had an absolute beginning is denied on two grounds: (*a*) as not ascertained in fact, and (*b*) as impossible in conception; the first is argued by science, which deals with facts; the second by speculative philosophy, which deals with principles.

The scientific objection rests upon these grounds in general: that origins do not come into the view of mind at all, and therefore cannot be made subject of scientific inquiry at all; science

deals with facts, and does not find origins among facts. It allows of changes in things, and attempts to account for them by the things themselves; but it denies that there is scientific evidence that the things themselves or the substances out of which they are composed have any beginning—that there is any proof of the great fundamental change from non-existence to existence. It takes the universe as it now is, and analyzes, classifies, and explores its component parts, and determines the laws and forces by which its varied changes of form, relation, and condition are effected. It deals also with the changes which have taken place in its history, and those changes which can and will take place under its known laws in given relations and conditions. In this way it goes back over the past, as it finds it chronicled in the system itself in visible facts. It passes down through a long series of past changes, which it proposes to account for by ascertained laws and forces, until it comes to the ultimate components, when all changes cease, and here it comes to a halt and says it can go no further, there is no other more ultimate fact on which it can fix. It will not raise the question, Whence come these ultimates? It has simply to do with the fact that they are, and with this to explain how all changes have been wrought.

Scientific objection.

If, stopping here, they assume that they have exhausted all reality they must with these alone carry forward all the processes which they find going forward and all the results of change with which they deal. This is the problem. Can they do it? They must find in these ultimates which go into the composition of all things and changes—ultimates of matter, law, and force as constituents of matter—"the promise and potency of all things," as has been asserted by a prominent devotee; the ultimates must be able to do all that has been done or they cannot account for it. If they, the ultimates, are impotent to the result, and if science has nothing more that it

Failure to account.

can do, then the mind, by a necessity of its nature, must posit something, that is, some fact of being which science does not and cannot reach back of its ultimates. And that something must be the adequate explanation of origins, the source of the facts with which science deals, the absolute Creator. Three considerations are fatal to the claim set up by the devotees of the "dirt theory." First, by definition of its advocates it is impersonal and unfree; its forces necessarily act; it fails, therefore, to be able to give account of itself prior to the evolution of itself; if by its nature it must act how could it be eternal? Every act must be in time. Second, by confession it is not intelligent; it fails, therefore, to account for the apparently intelligent manner of its operations. Third, by confession it is without life; it fails, therefore, to account for life. Its impotency is so great that any attempt to explain the facts of the universe from it alone is conceded to be a failure by the most eminent minds who deal with the problem.

Three things fatal to naturalism.

The necessity of an agency outside of the material system to account for it, that is, of a supernatural cause, is such that reason gives way and becomes unreason in attempting to resist it. The impotence of science makes no more against the doctrine of a supernatural cause than the impotence of mathematics in matters of morals makes against ethics. It simply lies outside of scientific inquiry, which deals with the facts of nature and not at all with its cause. When, on the ground that it has nothing to do with cause, it denies its existence, science transcends its sphere and drivels into idiocy.

The supernatural a necessity.

But at this point the question of origins encounters another objection from a different quarter, namely, the "impossibility of conceiving how *being* can be originated." This must be admitted without hesitation and without reservation. The how of a properly creative act is an absolute

Impossibility to conceive of origins.

mystery to human intelligence. But does it therefore follow that it *is* impossible? This would involve that our understanding of how a thing can be is the measure of possibility. This will not be pretended. But is it then said that, at least, we cannot rationally believe that a thing is possible and actual the how of which we cannot conceive? The answer is that this would limit our believing to our understanding, not of the fact which is matter of belief, but of how it became a fact. But this, again, cannot be assumed, and by a law of our mentality is impossible. We both necessarily believe and know the possibility and certainty of multitudes of things the how of which we do not comprehend—our own existence, for example. In this case we know that there must, in fact, be a properly creative act, since we know that we now are and that we once were not, and that to pass from nonexistence into existence requires a properly creative, causational exercise of power.

The lapse of almost infinite time since the beginning.

The second assumed certainty, namely, that there has been a lapse of almost immeasurable time since the origination of the universe, is confessedly a recent discovery, but a fact now well established. The popular belief which long held undisputed sway, and which lingers in some quarters, was that creation was a very recent event, to be measured by at most only a few thousand years. There were no known facts to contradict it. It was supposed to have the highest sanction, the revealed testimony of the Creator himself. Authentic history seemed to favor it, in that it carried back but a brief period and seemed to reach to the infancy of things. There were abundant traditions circulating among all people to the same effect. The idea seemed to be an heirloom of humanity, and carried unquestioning conviction wherever it circulated. Not only history and tradition bore testimony to the recent origin of man, but numerous facts established it beyond

dispute. That the world itself was much older than its inhabitants was not suspected.

How discovered.

Some strange facts were discovered in the constitution and position of the rocks. Inquiry was started. The facts multiplied and became more and more curious and interesting. More careful attention was given, and suspicion was engendered and expressed as to the truth of the popular theory of the recent origin of the world. It is within the memory of the gray-haired man, and need not be recited, how great the commotion that ensued. The result is that patient research has now established the fact beyond intelligent dispute that the beginning of the world must be dated back many, many millions of years.

Creation not instantaneous as a whole.

The same science has discovered also that the popular theory of creation is not sustained by the facts, that is, as long held and taught. That theory was that creation was begun and concluded in six solar days of twenty-four hours each. This also was supposed to be biblical and intrenched itself in the sanctuary of faith. It is certainly false. Better learning has discovered that such was not and never is the divine method. His plan extends through eternity: why should he be in haste? The examination shows that his movement was in the order of a continuous and systematic evolution or process extending over incomputable eons.

Primitive page.

The most primitive page records simply a vast accumulation of elements—impalpable atomic substances—an abyss of vapor, of uncompounded gases, each discrete atom of which was under law. This was the product of the only properly creative act until we reach life and spirit, formative processes being not properly creative but constructive. The power which creates and that which constructs is identical, but not coetaneous necessarily. These were the infinitesimal stones

out of which in unrolling eons the creative agent was to construct sidereal arches and evolve living races.

Thus furnished with material it has been discovered that slowly, in vast cycles of geologic time, the anarchic mass assumed spherical forms and condensed into flaming crystal orbs, and then into cooled and solid globes. The granitic bases of the continents, and the vast accumulations of metamorphic and crystalline rocks the world over, are the witnesses and ancient monuments of that lengthened era, proclaiming how long the fiery age continued and how universal its reign. Here are no memorials of life. Archaic suns and callow planets are but learning their centers and orbits, and getting ready for ages of life.

Growth of the cosmos slow and progressive.

We turn another page. The burning air has cooled, boiling seas have become tepid, cloudy vapors send down showers which form into rills and rivers; atmospheric changes and descending floods decompose crystalline rocks and spread out the loose and mellow soils and sands over the valleys and rolling lands. Conditions for vegetable growths exist. The azoic age gives place to the new era of life. Archaic forms of vegetation clothe the earth with verdure, and tropical seas swarm with primordial varieties of animal life. In ages of sunrisings and settings Siluria passes into Devonia, and on and on through successive eons the earth swarms with the successive tribes and families of animate existence. Old races perish, new orders are introduced. Carbonifera cords its wealth, and is covered away to provide thermal material for the use of man yet millions of years distant. Nutritious plants spring along the hills and higher plains, succulent fruits and berries hang from freighted shrubs and boughs for populations of bird and beast and the coming kingly race. Epochs come and pass, each pregnant with prophecy and purpose of a world of life still in the future.

Second stage.

Thus we read the record from the Laurentian rocks of the first formed sedimentations to the Pliocene of the most recent, from the Eozoon of the metamorphic deposits to the human age. We know the laws and forces which have accumulated these vast masses and piled them tier upon tier and stratum upon stratum to ten miles in thickness; they are now working under our gaze. We see the process still going on, doing for our time what it did for those times, registering the chronology and history of to-day with the same stylus and on the same kind of page as was employed for those ages. The process is perfectly plain. We know how the accumulations were made and by what agencies. We know the forces which posited the walls and the ratios of their working, and the forces which disturb and destroy. We see the result over all the surfaces of the world—not perfectly, but proximately. We know that

Time for changes.

to make these vast deposits required inconceivable measures of time. We know that the mass of the earth during that period has passed through great thermal changes—from a highly heated, perhaps molten, condition to

Things known.

its present temperature. We know that there was an almost infinitely long azoic period. We know that life has flourished through (probably) millions of years. We know that there have been epochs of life—that typical forms, characteristic of one period, have perished, to be followed by another order of typical forms. We know that there has been advance in the successive forms, each epoch introducing more complex and perfect organization. We know that each antecedent condition furnishes something, not only in juxtaposition and temporal relation to what is immediately to follow, but something also essential to and prophetic of what is forthcom-

No break in the chain.

ing. There is a deft correlation as well as consecution. There is no break in the chain from the first to the last link; but there are various elements in its composition

and progressive values in its parts. The first part is of iron, the second silver, the third gold, as to relative degree.

The most ancient link in the still growing chain is, first, created, impalpable elements, in their discrete and uncompounded forms—primitive atoms; the second is the same elements molecularized, separated into masses, and raised into palpable compounds; the third is masses grouped into systems of cooled and compacted worlds, with adjusted motions and fixed relations; the fourth is the appearance of low forms of vegetable and insensate life, rooted in and extracting its aliment from inorganic elements by a peculiar and unknown chemistry; the fifth is free locomotive and sensitive life, in organisms fashioned from the common elements, but not rooted in them nor taking nutriment from them, but receiving its aliment from the previously formed vegetable fiber through a stomach, and in all its almost endless varieties, from the lowest to the highest, exhibiting automatic mentality in greater or less degree; the sixth is a discrete essence, eluding sense, and known only by effects it produces in the visible substance of matter—a spiritual entity shrined in a highest type of sensitive, free locomotive organism, and exhibiting highest forms of mentality; a self-conscious, self-knowing, and self-governing subject, with powers of thought, feeling, and will purely subjective and personal. In a fitting order life crowns azoic ages and mind crowns life. Thus, with absolute diversity, there is pervasive and real unity; each part having relation to and dependence on its immediate antecedent; but at the same time each several part being distinct.

The order of development of creation and construction.

Six stages.

Divinity ends in unity.

Calmly, silently, slowly, magnificently the great work progresses. There is no stir, no confusion, no misdirection, no hurry, no useless expenditure of force anywhere; but there is advance and improvement everywhere.

Majesty of the movement.

The corner stone is properly laid, and in orderly tiers the mighty walls are reared. We stand midway of the uncompleted edifice whose unfinished arches still point onward. Broad as the rims of the sky and high as the cope of heaven it rises; but its pediment is yet wanting, and its dome awaits eternity for its final setting.

Mortals haste.

We mortals, whose life is a span, haste and chafe. He with whom "a thousand years is as one day," one moment, need not hurry. He posits a sun whose light will travel millions of years across immeasurable abysses of space and time before finding an eye to behold it. He plants a seed which holds five thousand years of growth in its tiny shell and patiently waits till it rears the giant trunks of the Calaveras forests. He sets myriads of microscopic insects in mid-ocean, to lay in infinitesimal stones of their own secretion the foundations of continents for use a hundred thousand or a hundred million years hence, and is not disturbed by the delay. He distills vegetable oils and lays down vegetable tissue, which are to be converted into bitumen for the use of some Vulcan in far-removed centuries, and bides his advent without disappointment.

God never hurries.

Might have been done in a moment.

All might have been done in an instant, we presume. A word would have been sufficient. *Esto*, with omnipotence to energize it, would have balanced the finished spheres in a moment. But he did not so choose. He would build in becoming grandeur for one whose power and skill are infinite; but he would take time and furnish a model of patient order to those finites who should afterward learn wisdom from his plans and methods. Invisible himself, he would concrete his power in atoms and make them put his thought in visible forms. Centripetal and centrifugal forces, modifications of gravitation and motion, should evolve worlds from anarchic masses; appointed affinities should select and arrange complex substances

Reasons for patient order.

Secondary causes.

for ultimate uses; intangible ethers should become highways for light and sound; dense atmospheres should conduct heat and support vapors; chemistry should extract qualities from crude matter out of which to build tissue for hungry germs; pairs of fecund animals should populate air and sea and land with sensational life; all forces should emanate from him and work out his will. Generation should follow generation and order succeed order. New races and types should come as the more ancient retired. The great gateways of death should stand open for effete individuals and races, and the portal of life should welcome advancing orders and kinds of living existence.

Death and life.

The series should not be that of unrelated parts, but a deft and integrated whole. Each precedent should be condition to each succedent. All the stages of progress should be toward completeness. Reading down, or up, the line we should see how each past prophesied each future. Thus, final cause, proclaiming the Infinite worker, should pervade the entire chain.

Series one whole.

We are to treat of the universe—the earth and the stars, worlds and their inhabitants, inorganic and organic existences, their scope in time and space, originations and ongoing, and the processes and laws discernible in the vast complex. The object is to find the facts which lie within our reach and as far as possible get an intelligent comprehension of them.

Strictly avoiding the technicalities and frequently, to the common reader, obscure formulations which encumber the pages of learned scientific treatises, and with purpose employing a popular style, it will be our aim to give the last results of learned research as accurately as possible, not in the dry nakedness of a mere skeleton, but in tint and warmth of life. It will not be for the want of purpose if the pages do not glow and burn as they recite the wondrous story of the universe, itself

aglow from base to finial with marvels which surpass the most extravagant dreams of fancy.

The proverb, "Truth is many times stranger than fiction," finds its best illustration in the simple facts of being which need but be known to ravish the thoughtful observer with wonder and rapture. For the want of knowledge and of language we shall fail to tell the story, to reach the summit of the mighty theme, but you, reader, will grow strong and great as you strive to expand your thought and imagination to grasp it. It is the wrestle with great facts and thoughts which broadens and deepens mind and gives fiber to the best powers and possibilities within us. We open to you here the loftiest ranges. Try your pinions.

SPACE MEASURES OF THE UNIVERSE.

BEFORE we take up the facts of the universe for examination it may be well to note some perplexing questions foisted upon us by speculative philosophy. The first of these perplexities is as to reality of the alleged facts, or, perhaps, to be perfectly fair, the determination of what the reality is. What are the facts?

Matter real.

The common-sense view, and that which we accept, is that the universe is an aggregate of real objects, as they appear to our sense. There is a real earth—we ourselves are real persons, and all the things about us, animate and inanimate, are real things, composed of real hard and fast substances, or having substance and reality of existence, objective and not merely subjective.

Over against this so-called common-sense view is the theory that there are no such realities, but only a power which supports and renders permanent in our consciousness ideas to which we impute, by a law of mind, real objectivity to what we suppose ourselves to perceive. The universe exists thus only in the mind and in the eternal energy which creates and supports the ideas.

We name this theory, which is supported by many of the ablest and best men we know, not for the purpose of attempting to refute it, but simply to say that it is not the view held in this treatise. Nor do we denounce it as infidel or certainly not true. It may be true. We find ourselves unable to receive it. If true it makes nothing against the conclusions of this treatise. The facts of the universe are the same whichever view we take. In one case the facts are real as forms energized in the mind by its Creator reducing the universe to ideas, but still making it

real as a product. In the other case the facts are objects external, corresponding with ideas. If we are unable to comprehend the meaning or to suppose it is a correct rendering of reality, we will be excused from accepting the ideal theory.

To us there is a real objective universe such as we all talk about and imagine that we behold and touch and handle; and of this universe we write. As our rendering of the facts will commit us to a temporal and spacial order we linger for a moment to call attention to these terms.

Space.

The phrase, "the universe as it exists in space," demands that we should explain what we mean by space. Space is a relative term. It does not denote any real existence or thing, but some relation merely, as relative position, magnitude, figure, among real things. Were there no extended objects the term would be meaningless. Ideas have no north side, or east, or west, or south, no bulk or figure. Terms of space do not apply to them. Space has none of the properties of matter—as length, breadth, and thickness, extension, ponderosity, impenetrability, figure, size, color, taste, odor, primary or secondary qualities; it has none of the attribute of spirits—no essence, no faculties; it does not feel, or think, or wish—is not conscious. It has no properties of any kind—is nothing. It is invented simply to denote certain kinds of relations among figurable things.

Universe in time.

When we speak of the universe as it exists in time or as to its temporal measures, the question arises, as it did with regard to space, "What do we mean by time?" Again, we answer, "Time is a relative term." It denotes no real thing, but simply a relation among real things. It is simply an order of succession among changing realities. Beginning, past, present, future, all terms of time, denote a relation

among things which exist, have existed, or will exist, or imaginary things arranged under ideas of relation.

The universe in space means the magnitude and relations of things as to position. The universe in time means the universe as it has existed in and through an order of succession, or series of changing phenomena, as sunrisings and sunsettings. Were there no such phenomena of change the term time would have no meaning, and all its uses would disappear; there would be no past, no future, no sooner, no later, no long time, no short time—no time. The term is relative. It does not apply to the Eternal Being. It applies to his acts which result in effects, not to himself.

Time, like space, has none of the properties of matter and none of the attributes of spirit. There are relations of sequence among realities—order, succession. The term is invented to denote these relations—nothing more. Having no properties, it is nothing but an idea of order and succession.

By the universe we mean the whole aggregate of things—whatever exists under conditions of time and space. The definition of purpose excludes God. His relation to the universe has treatment in another discussion.

Universe—what?

The universe may be viewed under three cardinal aspects, and must so be treated in order to get any proper conception. These diverse aspects sustain both a logical and actual relation to each other, a relation of temporal order and conditioning grounds. They emerge in limina—one antecedent to the other, and serving as the basis of the other. Thus the universe is discovered to be not merely an aggregation, but a system, all the parts of which cohere in an ultimate unity—a *cosmos*.

Three aspects of the universe.

1. We have first: The universe as mass of inorganic substance, called matter.

2. The organic universe. This comprises all forms of matter in which life appears—vegetable and animal.

3. The spiritual universe. This comprises orders of being who are endowed with personality.

These divisions are natural, real, logical, and exhaustive. Each opens up a field of profitable study; and we may venture the assertion, without which the proper understanding of the great theological problem—the problem of problems—the problem of the character of God and his end in creation—can never be solved or intelligently construed.

Nature is God's highest exponent. The things which exist and are known to have existed, and facts with relation to them, furnish the most direct information we have as to the attributes and aims of the infinite Author. These are the subjects of our present inquiry.

THE INORGANIC UNIVERSE.

Our investigation begins with the study of the inorganic universe. Logical propriety determines this order. The inorganic antedates and conditions the organic. The full significance of this statement will soon appear. The inorganic exists for the organic.

The inorganic universe comprises the vast masses of mere matter builded into worlds, and excludes all living beings.

The mere word "masses of matter," or the other word "world," conveys no adequate idea of the inorganic realm of existence. If we pluralize the terms and add millions of worlds we still gain no real concept. If we vary the statement into suns and moons and stars, and swell them into vastest number and spread them over what we are pleased to call infinite space, we still make no approach. Reality is definite. To get at reality the mind demands that terms have definite meanings, and that the exact meanings be perceived.

Masses of matter.

Matter is one of the terms here employed. What is its meaning? It might seem unnecessary to pause over so simple a term where the meaning is supposed to be so manifest; but simple terms are not always most easily apprehended, and, beguiled by their familiarity into the idea that we have their meaning, we often employ them without any definite idea at all.

Matter is earth and rocks, water and air, the solids and fluids and gases which we touch and handle and inhale—a something which has substance—is extended and imperishable; has weight and form and occupies space; has the reality of existence and is not a mere idea.

Matter—what?

Ultimately all matter—that is, all compounds or kinds of matter—is reducible to infinitesimal atoms, indivisible units; each unit has the property of extension or so-called occupancy of space.

There are but few persons outside of the ranks of the biological students that have any idea of what is meant by the expression "an atom of matter." When the microscope is applied to the examination of living tissue, whether that tissue be of animal or vegetable life, it is soon observed that all living things are made up of minute bodies called "organisms." Experts in the various branches of biological research will also tell you that no essential difference can be distinguished between those cells which go to make up the sum total of animal life and those which give the vegetable its existence. These life cells, although wonders within themselves, are made up of minute particles called "atoms," which are so small that they must ever remain invisible to the human eye. Some critical reader will say, "If this last remark be true, how can it be proved that such infinitesimal particles as your so-called 'atoms' exist?" To this query the reply would be that it is only when an untold number of these atoms unite themselves so as to form a single body, like the grains in a popcorn ball, that they become at all visible, and then only by the best appliances that optical science has been able to furnish.

This being the case, it is not an exaggeration to say that every little piece of matter which we are able to see is built up of millions upon millions of these atoms, which are so small that no mind can comprehend their minuteness, even when taken in aggregations of thousands. There are, of course, many different kinds of atoms, such as atoms of carbon, hydrogen, oxygen, etc., each of which is believed to have its own particular size and weight. Then, too, they probably differ in shape as well as size. According to the specialists in this line they combine

together by mutual attraction, which is in some cases called cohesion and in others chemical affinity, according as the atoms are of the different elements. This being the case, it is easy to understand why myriads of these atoms of all sizes and shapes, fitted snugly one against the other, combine together in varying degrees of intensity to build up structures possessing all the various degrees of stability and solidity. Some of the most wonderful theories ever advanced on the atomic theory are by Sir William Thomson, the English scientist. In one of these articles he proves by three different trains of arguments that an atom cannot be greater than the one one hundred and fifty millionth of an inch nor less than one five billionth of an inch.

Bishop Warren beautifully says: "Science finds matter to be capable of unknown refinement: water becomes steam, full of amazing capabilities; we add more heat, superheat the steam, and it takes on new aptitudes and uncontrollable energy. Zinc burned in acid becomes electricity, which enters iron as a kind of soul and fills that body with a kind of life. All matter is capable of transformation, if not transfiguration, until it shines by the light of an indwelling spirit. . . .

"When God made matter, so far as our thoughts permit us to know, he simply made force stationary and unconscious." (The best definition of idealism yet rendered.)

"Join in the long and microscopic hunt for the atom, and if found, or if not found, to a consideration of its remarkable powers. Bring telescope and microscope. . . . Make the first search with the microscope; we can count 112,000 lines ruled on a glass plate inside of an inch. But we are here looking at mountain ridges and valleys, not atoms. Gold can be beaten to the $\frac{1}{340000}$ of an inch. But the atoms are still heaped one upon another.

"Take some of the infusorial animals. Alonzo Gray says millions of them would not equal in bulk a grain of sand. Yet each of them performs the functions of respiration, circulation,

digestion, and locomotion. Some of our blood vessels are not a millionth of our size. What must be the size of the ultimate particle that freely moves about to nourish an animal whose totality is too small to estimate? A grain of musk gives off atoms enough to scent every part of the air of a room. You detect it above, below, on every side. Then let the zephyrs of summer and the blasts of winter sweep through that room for forty years, bearing out into the wide world miles on miles of air, all perfumed from the atoms of that grain of musk, and at the end of the forty years the weight of musk has not appreciably diminished. Yet unaccountable myriads on myriads of atoms have gone.

"Our atom is not found yet. We will pass in review the properties with which materialists preposterously endow it. It is impenetrable and indivisible, though some atoms are a hundred times larger than others. Each has definite shape—some one shape, some another. They differ in weight, in quantity of combining power, in quality of combining power. They combine with different substances in certain exact assignable quantities. Thus one atom of hydrogen combines with eighty of bromine, one hundred and sixty of mercury, two hundred and forty of boron, three hundred and twenty of silicon, etc.

"The atoms of luminiferous ether are infinitely more diffused; its interactive atoms can give four hundred millions of light waves in a second. And now, more preposterous than all, each atom has an attractive power for every other atom of the universe." *

Masses of matter are accumulations and collocations of these minute substances until they acquire bulk and size, become variously compounded and take on specific conditions, and are differentiable as solids, liquids, gases, clay, sand, rocks, metals. When they acquire great proportions and are separated from other masses, so as to take on an economy of

Masses.

* *Recreations in Astronomy*, pp. 241, 256–258.

motion peculiar to themselves, these large masses are called worlds, and collectively they are the inorganic universe—the all of matter.

The immediate object we have now in view is to put ourselves in possession of some idea of the vastness of these masses of inorganic substance. Having gained this point, our next effort will be to find out the economies pervasive of them and determining their constitutions and the ends for which they exist, thus discovering the powers of the Being who has made and ordered them, and yet deeper, in their ends or uses discovering the character of the mighty Maker. It is thus we study and measure men. Why shall we not bring the same method to the study of the Maker of men and of the universe?

Vastness of the universe.

MASSES OF MATTER.

Worlds.

WORLDS: How shall we get hold of the idea of a world? Not by ringing the changes on the word. We gain nothing by this. We must examine and measure the thing itself—see it on all sides, measure it in detail, build it inch by inch until it stands forth in our thought as a whole, as some city or monument that we visit does. Until we are at the pains to do this we delude ourselves with mere sounds without ideas, and fail of grasping meanings.

In studying worlds as inorganic masses let us begin with the world we know most about—the world on which we live and from which we make our observation of other worlds.

The single object we aim at now is to get a concept of the bulk or mass of world matter of our own world and other worlds known to exist.

The earth.

Take the earth as a primary study. The earth is now known to be a spherical body—an oblate spheroid, not completely round. Its longest diameter is proximately eight thousand miles. Its substance is wrought together in solid mass, that is, contactual or continuous mass, of hard and fluid matter reaching from its external surfaces inward to the center. Its surfaces present to the eye the appearance of a continuous plain, furrowed by river beds and ocean basins, and corrugated by ranges of hills and mountains, and measuring two hundred million square miles of surface, the greater part being water, only fifty million, or one fourth, land.

Try to think of this mass. Tax your faculties. Ascend some highest mountain and get a wide view. Take passage on one of the great steamships. Travel half a thousand miles each

day for many days to cross from shore to shore. Take the train on the great railways and travel the continents for weeks and months together. Pass from kingdom to kingdom and country to country. Spend years at it in continuous going; exhaust life itself in the pursuit. At the end you have seen but little narrow ribbons of its surface. The amazement grows upon you. When you return you talk of the great cities you have visited, the vast cathedrals and temples and tombs you have seen, the lands you have passed through, the seas you have navigated, but you have not seen a thousandth part of the surface which turns to the sun every twenty-four hours; no man ever did or could in the longest lifetime.

Pike's Peak.

Take Pike's Peak, that atomic feature of a single range of mountains, only a speck in the landscape; shave it off at the base, as you would remove a mole from the face or a wart from the hand; there is more material in that single speck than has been used in all the constructions of man from the beginning of the world to this day; yet compared with the globe itself it is less proportionately than a mustard seed upon its summit is to its mass. If there were not another world in space the earth itself would be the everlasting wonder of men and angels, viewed simply as a mass of inorganic matter, the only aspect in which we are now studying it. Further on we shall see its deeper lessons.

How the universe appears in daylight.

Standing upon the earth and anchored to it by a fatality which we have no power to overcome, we look upward and away from it. What do we behold? To the seeming, in the daylight hours, we gaze out into an infinite void. From horizon to horizon there is but a single speck to arrest our gaze, a small luminous object, round in figure and dazzlingly effulgent, but less than the dome on our capitol, not larger than a carriage wheel, a disk of burnished gold, twenty inches in diameter; we name it the *sun*. It is a fixture. Each day it

appears on the eastern horizon at a given minute, passes over our heads and disappears behind the western horizon. Night shuts in. A figure of similar form and size, attended by a multitude of brilliant points, comes out to view. The sky is full of them; we name them moon and planets and stars. What are they?

Let us keep in mind that for the present our sole inquiry is, What are they as objects, specifically as to their dimensions? We do not now raise questions as to their relations, functions, and economies. These points are in abeyance for the present.

That they are real objects and not mere illusions we know. They are given merely to the sense of sight. We are separated from them by impassable space. They seem to be merely luminous disks of small diameter and smaller points. So for ages and until a recent date they were thought in reality to be. The discovery that they are not such is one of the most wonderful achievements of the human mind.

Night wonders.

They are now known to be vast masses of matter-worlds, some smaller, many of them, indeed, all of them, but less than half a score, almost infinitely larger than the earth which we inhabit, and composed of precisely the same substance which our feet press and our hands handle. In considering them as masses with reference solely to the extent of the universe, we must think of them as to the measures of space which they occupy, which involves the distances they are asunder, as well as the spaces which they fill.

So long as men were dependent on mere unaided vision these were problems of impossible solution. Ages of speculation left the mystery untouched. It is the wonder of wonders that it did not forever remain so. The magnificent conception of Copernicus, formulated by Kepler; the discovery by Newton of the great law of gravitation, possibly first suspected by Kepler, but finally formulated by the great astronomer

whose name it bears, and ascribed to an accidental discovery; the similarly accidental discovery of the lens; finally, the spectroscope, have jointly furnished the key by which the mystery of the sidereal universe has been resolved. Newton gives us the law which has been found to determine and regulate the relations and motions of all worlds. Copernicus has given us the solar system.

The lens multiplies the power of the eye so that we can carry our observations many thousand times further into space than was possible to unaided vision, and so discover universes a thousand—many thousand—times greater than that before known. With the aid of these clews we begin our investigation.

Some mention has already been made of our earth home, as to its magnitude. Of it we have a tolerably clear conception as a vast globe but measurable by imagination. It is found to be a member of a system or small group of worlds which takes the name of the central body around which it and the other members move, the solar system.

THE SOLAR SYSTEM.

IT is natural and proper that we should begin our investigations with a more careful survey of this system. The study will prepare us for the more extended survey of other systems out beyond to the rims of the universe as now known.

The solar system comprises our sun and its retinue of nine or ten planets and their satellites, with a group of asteroids, supposed by its location to be fragments of a disrupted planet, numbering two or three hundred, not visible to the eye, or possibly minute bodies never massed into a greater globe.

THE SUN.

The sun.

The sun is the fixed center of the system around which other members revolve in periods of definite but longer or shorter time. It is proper that we should begin the survey by first calling attention to that amazing body. To the eye it seems to be infinitely small compared with the earth; in reality it is discovered to be almost infinitely large. As stated already, it is found to be a fixed body; that is, to be stationary with respect to the other members of the group, and indeed relatively to the other stellar systems. If it has any orbital movement that fact is not ascertained with certainty, and if a fact, it does not change its relation to other stellar bodies, but must be in some vast revolution through periods of unimaginable time, in which all other bodies of the universe move in harmony around some as yet unascertained center. It is known, however, to have an axial motion, to revolve about its own center in the same direction with the other members of the group, completing a revolution in every twenty-six days, about six times the velocity of our axial movement.

We have already hinted at the magnitude of this amazing body. It is important that we should further ponder this point on many accounts. It is the center of the system. It has sovereign relation to the other members. Its attraction governs them all and determines their movements, anchors them in bounds which they cannot pass. It is king over a vast region of space where it holds absolute dominion, not simply over its own planetary children and subjects, but against the invasion of all other world systems. There, rooted fast in the infinite void, it holds absolute empire. There it burns and shines forever with undiminished splendor. Nothing is more amazing than this fact. Neither its brigthness nor fervors ever appreciably vary or wane; the emblem of its Author, "the same yesterday, to-day, and forever," or until its appointed time; its flame so dazzling that no eye can gaze upon it for a moment, flooding immeasurable realms of space through immeasurable ages with unfading brilliancy. Matchless monarch! But we were to speak of its magnitude. It seems not larger than a carriage wheel—hardly so large. We wonder at its shining.

The governing body.

Let us try to get some idea of its real size. It has been measured and weighed. There is no uncertainty about the accuracy of the result. We have but to try to grasp it. We have alluded to the planets, satellites, and asteroids, or worlds like our earth, most of the planets larger, the others smaller; we have some conception of the earth. The sun is seven hundred times larger than all of them put together, or 1,300,000 times larger than the earth taken alone.

How shall we grasp this amazing magnitude? We must resort to illustration; mere statement fails to give any idea. The earth is 8,000 miles in diameter; the sun is 880,000 miles in diameter. Still we fail to get an idea except that one is much larger than the other. Let us try again. Suppose the sun a hollow sphere with a 1,000-mile

Earth magnitude.

thickness for the shell. Imagine an opening into it 8,000 miles in diameter, a great auger hole 8,000 miles across, further than from San Francisco to the Bosporus or Constantinople, across the continent of America, the Atlantic Ocean, and the continent of Europe. Now collect 1,300,000 worlds the size of ours and drop them into this immense cavern, and they will only fill the void; or, instead of this, drop our earth in and let it settle at the center of the cavity, and then drop our moon in and let it take the precise position with relation to the earth which it now occupies, 240,000 miles from it, and now let it commence its accustomed revolution; the orbit it will describe will be equidistant from the earth and the inner surface of the shell.

Sun magnitude.

"There is no point on the surface of the globe that unites so many awful and sublime objects as the top of Etna, and no imagination has dared to form a description of so glorious and magnificent a scene. The body of the sun is seen rising from the ocean, immense tracts of both sea and land intervening; the islands of Panara, Alicudi, Lipari, Stromboli, and Volcano, with their smoking summits, appear under your feet, and you look down on the whole of Sicily as on a map, and can trace every river through all its windings from its source to its mouth. The view is absolutely boundless on every side, so that the sight is everywhere lost in immensity. Yet this glorious and expansive prospect is comprised within a circle about 240 miles in diameter and 754 in circumference, containing 45,240 square miles, which is only $\frac{1}{53,776,608}$ part of the surface of the sun; so that fifty-three million seven hundred and seventy-six thousand six hundred and eight landscapes, such as beheld from Mount Etna, behooved to pass before us before we could contemplate a surface as expansive as that of the sun; and if every such landscape were to occupy two hours in the contemplation, as supposed above, it would require *twenty-*

four thousand five hundred and fifty-four years before the whole surface of this immense globe could be in this manner surveyed." *

It has been already stated that the solar system which we are now considering comprises a definite group of worlds under one group of economies, constituting a system within itself. The sun belongs to the greater universe system. The other members of the group are called planets. There are nine of them, varying in diameters from Vulcan, which is the least, to Jupiter, which is the largest. Besides there is a cluster of very small bodies, occupying a place where there ought to be a tenth planet. These are known as asteroids or planetoids. There are several hundred of them already known, and they have an economy of motion among themselves. They are supposed to be fragments of a disrupted planet, and collectively would make a body about the size of Mars, which is the planet next them.

Solar system.

The planets revolve about the great central member of the system—the sun—in fixed orbits of various dimensions, and with varying velocities and on shorter and longer periods. They also have an axial revolution in varying time. The orbital revolution determines the length of their year, while the axial determines the length of their day. The extremes are great—reducing the day in some cases to ten hours, and carrying the year up to two hundred and eighty of our years, and in some cases reducing it to two thirds of ours.

Planets.

The planets in turn become centers of inferior groups, called satellites. The number varies. One, at least, is known to have eight. Our earth home has one. Of these subsidiary bodies between twenty and thirty have been discovered; some of them only inferior in size to some of the smaller planets.

Planets become centers.

The entire solar system—sun, planets, satellites, and asteroids

* Dick, *Celestial Scenery*, p. 214.

—comprises several hundred bodies, or if we call the planetoids one, about forty, which must be classed as lesser and greater worlds, under economies peculiar to the system, and amid extreme complexity of motions, orbit within orbit, maintaining absolute harmony and subserving various functions of usefulness and grace to the life which pervades the system—a beautiful and sublime universe within itself. In fact, it is but one of innumerable similar systems overspreading illimitable spaces, making the vast system of worlds of unknown extent.

As this system, best known to us, may serve as a key to all other outlying systems, it will be of advantage if we linger for its yet more particular study.

Keep in mind that the one thing we have in view now is to get a clear concept of the space measures of the universe; and in order to that we now seek to get an idea of the space measures of our own solar system.

It has been already stated that the planets are grouped about the sun at various distances, and that they describe orbits of various diameters in regular but differing periods of time about their common center. Our search now is to find their respective distances from the sun.

VULCAN.

Vulcan, of whose existence even we had no knowledge until recently, and which is even yet in dispute, is the innermost and smallest of the planets. It is located and has its mean orbital path about fifteen million miles from the sun. Its motions, orbital and axial, are both still undetermined. Its distance only is proximately ascertained. It is the shortest distance in celestial measurements except in the case of satellites. But it will be of service to endeavor to form some concept of this amazing distance before we approach the larger measures of the solar system, but especially before we grapple

Vulcan, distance from the sun.

with the still greater spaces in the sidereal systems. *Fifteen million miles*—nothing to infinite space; but yet all that we know of measurement is as nothing compared with it. Eighteen hundred and ninety of our world, if placed in line, would find room between Vulcan and the sun, or seventy-five moons, each separated from the other as far as our moon is separated from us, could stand in line to cover the enormous space.

MERCURY.

Mercury, next in order, is better known, and yet it is seldom seen without special search with an instrument. Its place and habits are familiar to astronomic science. Its orbit lies about thirty-seven million miles away from the sun, or twice and proximately a half as distant as Vulcan. Its motions and magnitude are measured and determined. It is thirty-one hundred miles in diameter, and its orbital revolution requires eighty-eight days. Its axial revolution is about the same, but only minutes less than that of our earth.

Size, distance from the sun.

VENUS.

Pursuing our course outward, we next come to Venus. This planet is universally regarded as the most beautiful of the group, and, indeed, unsurpassed in the entire celestial scenery, competing with our moon for the title "queen of heaven."

Venus the beautiful.

Our nearest neighbor, it is also nearly of the same dimensions of our earth, having a diameter of seven thousand seven hundred miles. Its position is about sixty-eight million miles from the sun. Its orbital revolution is accomplished in two hundred and twenty-five days, a little less than two thirds of the time required by our planet, while its axial revolution occupies twenty-three hours and some minutes, making its day practically the same as our own. It is now known to have an

atmosphere of volume nearly equal to that of our earth, and its light is radiantly beautiful.

EARTH.

The earth comes next in the order of distance. It, as is well known, is about eight thousand miles in diameter, and moves in an orbit of proximately ninety-two millions of miles from the sun and about twenty-five millions exterior to that of Venus, with an axial movement nearly identical with that planet; its day being twenty-four hours and its year three hundred and sixty-five days and about one quarter. We have become so well acquainted with the facts and economies of our earth home that it makes easy many matters concerning the general universe system that otherwise might have remained insolvable. For the first time we encounter the satellite feature of the universe system in the moon which attends our earth, and which, because of its near neighborhood, is so charming a companion. It, like the planets, shines with a reflected light. Its distance from us is only an average of two hundred thousand miles, and its size is only about one fiftieth that of the earth, or only about two thousand miles in diameter.

Earth.

MARS.

Next us and exterior is the planet Mars. The distance which separates us from it is, as we would expect, greater, being about forty-seven million miles, and placing it remote from the sun more than one hundred and forty million miles. The observed order in the interior planets of increasing size here is not sustained, the diameter of Mars being only four thousand one hundred miles, just more than one half that of the earth. Its axial motion is nearly identical with that of the earth and of Venus. Its day is a few minutes longer than ours, being twenty-four and a half hours; but there is a great leap

Mars the first exterior planet.

in its orbital movement, its year being six hundred and eighty-seven days, nearly twice the length of ours. As we would expect, it is attended with two satellites to our one; but they are less than our moon.

ASTEROIDS.

Still further outward, next to Mars, and at the distance of about two hundred million miles from the solar center, where, according to the analogies of the system, a planet should be found, we come upon a large group of several hundred planetoids of very small size—only a few miles in diameter the largest of them, and not collectively, so far as yet known, equal in mass to the smallest planet. They are generally assumed to be fragments of a disrupted world, but with no certainty of the truth of the conjecture.

A ruptured planet.

JUPITER.

Jupiter the magnificent is next in order. His position with relation to other bodies in the system is midway between the asteroids and Saturn, the asteroids being scattered over a space between two and three hundred millions of miles from the sun, and Saturn being eight hundred and eighty-one million miles. The place of Jupiter is four hundred and fifty-seven million miles. He is justly styled the magnificent, being the largest and most brilliant of the solar group. His diameter is about one tenth that of the sun, being eighty-seven thousand miles—ten times that of the earth; and his volume being equal to one thousand three hundred of our world. He is attended by four moons of varied dimensions, which are easily seen through a telescope of moderate power, some of them being visible at times to the human eye. One of the moons is larger than the planet Mercury.

The magnificent.

Bishop Warren, in his captivating and most suggestive and instructive volume, *Recreations in Astronomy*, says: "If

the Jovian system were the only one in existence it would be a surprising object of wonder and study. A monster planet, eighty-five thousand miles in diameter, hanging on nothing, revolving its equatorial surface forty-five miles a minute, holding four other worlds in steady orbits, some of them at a speed of seven hundred miles a minute, and the whole system carried through space at five hundred miles a minute." *

Of this amazing body one of the most amazing facts is the rapidity of its axial revolution, which is accomplished in less than ten hours, making its day but two fifths that of the earth, and requiring its equatorial surface to move twenty-four thousand miles an hour. Its orbital revolution is accomplished in about twelve years, and its motion is at the rate of nearly five hundred miles a minute.

SATURN.

Continuing our journey outward from the great solar center, we find ourselves, at the end of eight hundred and eighty million miles, four hundred and twenty-three million miles away from Jupiter, counting Vulcan as one, and the asteroids, an eighth group—the Saturnian. Saturn, with his rings, has ever been regarded as the only rival of Venus for beauty. Seen through a great telescope it is the most fascinating and wondrously beautiful body in space. To the eye it lacks the brightness of Jupiter and does not compare with Venus. It is only less than Jupiter in size, being in mean diameter about seventy thousand miles. For a minute description of this unique body see any work on astronomy. The history of research on the subject is exceedingly interesting, but is not in the line of our object in this discussion. The Saturnian body, as stated, is proximately seventy thousand miles in diameter. The rings are separate from the body at distances ten thousand miles first; ring second, eighteen thousand miles;

Saturn the unique.

* *Recreations in Astronomy*, p. 167.

then a gap of near two thousand miles; then a third ring of ten thousand miles wide; then the eight moons in exterior orbits. The whole presents the most sublime spectacle imaginable.

The axial revolution of Saturn is nearly the same as that of Jupiter, being a few minutes more than ten hours. Its year is about twenty-nine and a half of our years.

URANUS.

Still continuing our journey outward at a point beyond Saturn nearly a billion miles, and from the sun 1,800,000,000, or one billion eight hundred million miles,* we come to Uranus, more than double the distance of Saturn, by far the largest interval between any of the planets. It was long supposed to be the outermost planet of the solar group. It lies too deep in space to be seen by the unaided eye, but is easily seen by the aid of an ordinary telescope. It is known to be attended by four, with probability of six, moons. Its ascertained diameter is about thirty-two thousand miles, four times that of the earth, and not quite half that of Saturn. Its distance is too great to furnish data for calculating its axial revolution, but its orbital movement is well known. It requires eighty-four of our years to complete one revolution. Its orbital velocity is proximately—exactly, in fact—two hundred and fifty-two miles per minute throughout its long and solitary journey round the solar center. We have reached a distance, the measure merely of a radius of an amazing circle, which makes the mind reel and stagger in the contemplation.

The wonder of its discovery.

NEPTUNE.

Once more we start on our outward journey. Phenomena discovered in Uranus—disturbances of motion—lead to the conjecture that there must be lying out beyond it still another

* French method of enumeration.

planet, so accurately has science calculated the laws of motion in these remote spaces. Careful calculation determined about at what point in the immense periphery of space the disturbing body must be located. Turning the telescope to that point the unknown stranger was soon discovered, and Neptune was registered in the brilliant galaxy. He retains his heraldic honor up to date of being the eldest of the solar progeny—the outermost and most ancient of the planets. His place is found to be 2,775,000,000 miles from the sun, about 1,000,000,000 miles from his nearest neighbor and next of kin.

The outermost planet.

VASTNESS OF THE SOLAR GROUP.

THREE points deserve special attention: first, the magnificent scale of the system as to spatial extension or domain. The domain of the solar system, as described by the orbit of Neptune, is an area of 5,550,000,000 miles in diameter, or, if we allow it a share of one half the space between it and its nearest solar neighbor, a domain of 40,000,000,000,000 miles in diameter. The planets under its immediate control are within the first-named inclosure in the space circumscribed by the orbit of Neptune. Within this inclosure we have seen that the planets describe orbits within orbits. Within this area these great globes perform their wonderful evolutions. How shall we get a concept of these amazing distances and amazing magnitudes? To do so we must employ a measure of which we have some conception. We might employ the velocity of a cannon ball—twelve miles in a minute—but it would scarcely help us. Let us use a more familiar measure, the average speed of an express train or a locomotive—thirty-eight miles and a fraction in an hour. This measure has two advantages: it is perfectly comprehensible, and it requires just three years to make one million miles. Now we seek to get an idea of the domain inclosed in the orbit of Neptune or of the solar system. To do this let us in imagination project a railroad from the sun to Neptune, and place our locomotive on it and start it from the sun at a speed of thirty-eight and a half miles an hour, and suppose it to run continuously; we should have this result: at the end of forty-five years we should cross the orbit of Vulcan, that is, the path the planet travels around the sun; at the end of one hundred and eight

Measures of the solar system.

years we should cross the track of Mercury; at the end of two hundred and four years we should cross the track of Venus; at the end of two hundred and eighty-five years we should pass outside the orbit of the earth; at the end of four hundred and twenty-six years we should cross the track of Mars; at the end of one thousand four hundred and fifty years we should pass beyond the orbit of Jupiter; at the end of two thousand six hundred and seventy years we should cross the path of Saturn; at the end of five thousand four hundred years we should pass the orbit of Uranus; and at the end of eight thousand three hundred and twenty-five years we should come to the orbit of Neptune. Had Adam started on the journey at his birth he might now, according to the most liberal chronology, just be coming to the end of his ride; and if now he would reach the nearest of the fixed stars he must extend his ride sixty million years more. Such is the measure of the empire of our solar system as determined by science.

If now we consider the magnitude of the bodies composing the system we have this result: of the whole number two are only about half the size of the earth, two are nearly its size, and four are many times larger, the largest being one thousand three hundred times as great.

Who can reflect on the effulgence of solar bodies without feeling awe of the wondrous power which feeds their fires through infinite ages, so that their luminosity remains undiminished, shining on and flooding the infinite abyss while generations and eons come and go as transient dreams; ever the same, keeping their silent vigils while decay and death destroy all sublunary existence; suns sending messages to kindred suns over spaces so remote that the fleet courier reaches his destination only after the flight of millions of years; lighting up the way of planets and their freightage of life as they revolve in their great circuits

at a velocity a hundred times greater than the flight of a cannon ball! And these amazing velocities, who can think of them without terror of the power which impels and guides them, rushing along their unstaked paths so that they do not deviate an inch in all their course, and coming to their time to the fraction of a second in a million years? Surely, "The heavens declare the glory of God; and the firmament showeth his handiwork. Day unto day uttereth speech, and night unto night showeth knowledge. There is no speech nor language, their voice is not heard [they have no voice—make no sound], yet their line is gone out through all the earth, and their words to the end of the world."

Facts of the planets.

It is a curious fact of planets that there seem to be fixed ratios with respect to their distances, volumes, and densities, and that this should have been discovered. "The primary planets show a progressive increase of bulk and diminution of density from the one nearest to the sun to the one most distant. With respect to density alone we find, taking water as a measure and counting it as one, that Saturn is $\frac{13}{32}$, or less than half; Jupiter, $1\frac{1}{24}$; Mars, $3\frac{3}{37}$; Earth, $4\frac{1}{2}$; Venus, $5\frac{11}{15}$; Mercury, $9\frac{9}{10}$, or above the weight of lead. Then the distances are curiously relative. It has been found that if we place the following line of numbers,

$$0 — 3 — 6 — 12 — 24 — 48 — 96 — 192,$$

and add 4 to each, we shall have a series denoting the respective distances of the planets from the sun. It will stand thus:

$$4 — 7 — 10 — 16 — 28 — 52 — 100 — 196$$

Mercury, Venus, Earth, Mars, Asteroids, Jupiter, Saturn, Uranus.

It will be observed that the first row of figures goes on from the second on the left hand in a succession of duplications or multiplications by 2. It was remarked when this curious rela-

tion was first detected that there was the want of a planet corresponding to 28; the difficulty was afterward considered as in a great measure overcome by the discovery of a group of planetoids revolving in the space between Mars and Jupiter. It is a still further curious fact that the distances bear an equally interesting mathematical relation to the times of their respective revolutions round the sun. It has been found that, with respect to any two planets, the squares of the times of revolutions are to each other in the same proportions as the cubes of their mean distances—a most surprising result for the discovery of which the world is indebted to Kepler. Sir John Herschel well observes: "When we contemplate the constituents of the planetary system from the point of view which this relation affords us it is no longer mere analogy which strikes us, no longer general resemblance among them, as individuals independent of each other, and circulating about the sun, each according to his own peculiar nature, and connected with it by its own peculiar tie. The resemblance is now perceived to be a true *family likeness;* they are bound up in one chain; interwoven in one web of mutual relation and harmonious agreement; subjected to one pervading influence which extends from the center to the furthest limits of that great system, of which all of them, the earth included, must henceforth be regarded as members." *

A better knowledge of the constitution of the sun, which may some time be obtained, may explain the curious phenomena; at present they must be viewed as remarkable facts. The orbital velocities of the planets have a similar proportion. The motion in miles per second is as follows: Mercury, 29.55; Venus, 21.61; Earth, 18.38; Mars, 14.99; Jupiter, 8.06—here we perceive the gap occasioned by the absence of a planet replaced by the asteroids—Saturn, 5.95; Uranus, 4.20; Neptune, 3.36. †

* Taken from *Vestiges of Creation*, pp. 8, 9. † Warren, p. 105.

ECONOMIES OF THE INORGANIC UNIVERSE.

THE economies of the inorganic universe are not less amazing than the magnitude of the bodies which compose it and the semi-infinite spaces which separate them. If we are drowned in wonder in the contemplation of this, wonder and awe are lost in admiration and reverence as we think of them. If mere bulk and brilliancy and breadth overwhelm us, what shall be our emotions as we behold the harmonies of the heavenly bodies?

There are four aspects in which they are to be contemplated under the general concept of economies: (1) They are hung upon nothing out, in, and over the empty spaces—founded not even upon air, but upon emptiness—void. Every building hath foundation, but what upholdeth the pillars of the sky? Above, beneath, around, infinite void—neither bracket, nor brace, nor support; ponderous with infinite weight, but suspended on nothing. (2) The second aspect is their absolute fixity. We refer now to the stellar bodies—the great solar centers, and with reference to their relation to each other. We do not know that they have any motions except axial. They are known to revolve, and they all move in harmony with unchanging relation over immeasurable fields of space. But we do know that, whatever their motions, their special relations to each other are fixed. The "bands of Orion" are not broken, and the constellations are not variable. Each star occupies its exact place, more absolute than if spiked in framework of steel. (3) The third aspect is that of the motions of the planetary bodies. If the stellar bodies are fixed the planets are in perpetual motion. Two things amaze us, the unalterable

Economies of the system.

courses they pursue and their velocities. They are endowed with two motions, one axial, the other orbital; one through space, the other in space. To these we call attention. These motions, both one and the other, are known to be absolutely regular; but each body has its own rate of motion, both axial and orbital. For the illustration we select one or two examples.

Our first example is taken from our own earth home. It makes a complete revolution once in twenty-four hours, which makes our day and night. If this were its only motion it would be as fixed in space as the sun itself, and would never, except in its surfaces, change its relations to its sister planets or to any of the fixed solar bodies; there would be no wandering stars. The velocity of its revolution is such that we are borne along through space at the rate of nearly seventeen miles in a minute, or once and half the speed of a cannon ball, yet never feel the motion. Its orbital motion, which makes our year—that is, its motion around the sun—is still more wonderful, being at the rate of a fraction over seventeen miles in a second of time, or nearly seventy times faster than a cannon ball. All the planets have corresponding but less and greater velocities both axial and orbital. Their motions are absolutely regular, passing in their courses over the same spaces in precisely the same time. These amazing velocities transcend imagination. In our system, which is doubtless in general features similar to all solar systems, the planets have their satellites, which in turn revolve in their orbits around them as they revolve around the sun. Each member of the system has its fixed place and absolute orbit, orbit within orbit. Each pursues its strict and invariable course with strict and invariable velocity, never crossing the path of any other or trespassing on its domain; each attracting every other, but producing no disturbance; all moving in absolute harmony.

The earth motions on its axis.

Velocities.

Could we occupy a fixed position, and were we endowed with

power of vision that would command the entire area occupied by the whole universe, and could we see each world in its actual size and precise relations of distance to every other, how amazing the spectacle we should behold!—the immensity, the vastness, the complicate but absolute harmony; the great suns motionless or changeless in position; the planets careering in countless orbits with varied but inconceivable velocities in every direction, course cutting course; their satellites rushing on their ways in lesser spheres in reverse and counter courses, like a chaos of burning wheels, but all working with the harmony of a perfect machine in which no wheel is astray and no cog displaced; the great clockwork of the universe measuring out its time to the thousandth part of a second in millions of ages.

(4) The next aspect we note is the permanence of the complicate system, the undiminishing persistence of the mysterious force which holds them in existence and conserves their relations. Atoms have formed new alliances, have been compounded and recompounded, have now been collocated in one way, now in another; may have changed places and relations by the breadth of the globes which they compose; but there is no evidence that a single atom has perished or of any power which works to their destruction. There is evidence of an economy of growth and development, but not of increase of substance. Planets have their bulk and evolutions from one stage to another, their changes from chaos to maturity and decay, but as far as is known do not disappear. Their changes indicate other uses and are for ulterior ends. It is supposed that as the universal system had in some remote past a beginning, which is among the *demonstrable* facts, there will come a time when it will have an end or transformation into a new and higher form for new and higher uses, and that there are signs of such a change; but if such a change shall come it must be at some far distant future and by the same power which started it on its amazing career.

MODE OF MAKING THE SOLAR SYSTEM.

Sidereal universe.

BEFORE we leave our survey of the solar system for the wider survey of the universe we ask attention to the process of its erection. It is now certain that the great Builder has consumed immeasurable ages in its construction; that not only is it built on a scale of inconceivable vastness and with consummate skill, but also that the work has been carried forward according to a perfect method pursued through infinite reaches of time. First the suitable material, then the structure. Geology discloses the fact that at an inconceivably distant period the foundations of the earth were laid. There is abundant evidence that with respect to the earth, which serves as a clew to the whole process of world building, its first condition was that of a molten mass, or, earlier still, mere primordial elements. In ages—how long cannot be ascertained—it assumed the form of a molten mass refrigerated and solidified or crusted over on the surface with probably a yet remaining molten interior.

When the solid crust was formed a secondary surface began to appear in the form of stratified deposits. By means of these we are able to trace with scientific certainty and proximate accuracy its subsequent history up to date. The agencies at work in producing superficial deposits over the earth's surfaces are well known, and the rate at which the deposits are made is proximately ascertained. No one who has studied the problem doubts that millions of years have been consumed in piling up these immense stratified accumulations.

But if now we push our researches further back, as we are able to do, to the period when the earth was a molten ball,

who shall tell us of the eons which elapsed during the process of the formation of its refrigerated crust? And if, again, adopting the nebular theory, to which all the facts seem to point, we push our researches back to the universal fire mist during which solar foci were determined which divided the infinite mass into segregated parts, and watch the process by which worlds were evolved, how infinitely our line is extended! By supposition we have reached the point when the mass of which our solar system is formed was disseminated over the space which extends midway to neighboring solar foci—half way to Cygni. Then, atom by its law rushing to its kindred atom, the process commenced. The law of attraction drew the atoms toward a common center, imparted rotary motion, developed the law of centrifugal force. Condensation, in ages how long, reduced the as yet undivided mass, revolving around the point which is now our sun, to a globe the dimensions of the orbit of Neptune, when the increasing velocity threw off or dislodged from the parent mass a portion sufficient to make that planet, the oldest and first born of our planetary sisters. Then again, in ages how long, when the mass had condensed to the orbit of Uranus, by a similar dislodgment that planet commenced its orbital movement, held like the other in its orbital path by the two forces, centripetal and centrifugal, which forever determine its place, and so down through till each planet in turn assumed its place and the system was completed—the solar center still reducing to its present compact form. If this rational but undemonstrated theory be true the dawn of creation, which is the birthday of time, is pushed back to a date compared with which geological eons are but transient moments.

BEYOND THE SOLAR SYSTEM.

BUT this rough sketch of the solar system is but the first page of the marvelous revelation. For the solution of the matchless problem we must extend our researches into remoter regions of space.

Looking up into the heavens, we discover beyond the domain of the solar system, by unaided vision, innumerable other bril-

Number of the visible stars.

liant objects, now known to be worlds. There are, indeed, but about six thousand of them visible to the eye—less than half that number visible from any one point at one time. These are discovered to be absolutely fixed bodies, that is, to maintain unchanged relations to each other and to our solar center. This fact, together with their self-luminous character and vast magnitudes, determine them to be of the order of suns and not planets, and warrants the idea that they, as our sun, are centers of groups of worlds resembling our solar system. Science determines with accuracy that these vast solar centers are distributed at points proximately equidistant over the field of space, the measure of separation being from twenty to thirty millions of millions of miles. The depth to which the eye carries us is found to be through twelve of these sidereal measures, that is, the remotest star visible to the eye is determined to be about twelve times as far as the one nearest to us by actual measurement. It is found that the light and apparent size of the bodies diminish in the ratios of their distances, until they finally fade out and we find ourselves in a pale milky zone in which no individual objects are discernible, beyond which is darkness. Whether these remoter depths are inhabited by farther away suns and systems the eye fails to

tell us—the dim light discoverable beyond is suggestive merely. But let us now return to examine more carefully what we have thus briefly stated.

The area described by the penetrating power of the eye is seen to be a sphere the radius of which is, say, 360,000,000,000,000 to 500,000,000,000,000 miles. This, of course, transcends all power of conception; illustration may aid us. Light, at a speed of 12,000,000 miles in a minute, would traverse the radius in 80 years or less, or the diameter of the sphere in about 160 years; but a velocity of 12,000,000 miles a minute simply stuns us and conveys no idea. Let us return to the locomotive, and fix the rate of motion at 38 miles in an hour, or 1,000,000 miles in three years, we do understand the rate of motion. Our journey is from our sun outward to the rims of the visible universe. By a former calculation in describing the solar system we found that at the above rate of speed, without stopping for a moment, we should pass beyond our outer boundary, the orbit of Neptune, in about 8,000 years, and now pursuing our journey we should reach our nearest solar neighbor in about 60,000,000 to 100,000,000 years, and at the end of about 1,080,000,000 years should reach the outer boundary of the visible universe.

Distance measured by light.

But as yet we have but contemplated the universe as given to the eye. Until within a recent period that would seem to have been the whole extent. That other and incomparable heavens existed and would at some future time be revealed scarcely entered the dreams of men. But the diligent research which finally disclosed what those visible heavens were developed the fact that out beyond there were still greater wonders awaiting discovery. There were stray hints in unexplained phenomena. The eye had exhausted its power, but genius, unsatisfied, busied itself with invention. The lens, in part by a happy accident, was discovered. It was found to be able

Universe of the telescope.

to double them to thousandfold the eye which God had given. In addition to magnifying and making more plain and beautiful the visible heavens, and thus aiding in deciphering them, it was found to have another more important power, that of extending the vision, penetrating into new and more distant regions of space. The result was the discovery of a new universe so much more wonderful than the old that the old dwindled into insignificance. To the six thousand suns it added millions. Out beyond the dim stars of the sixth magnitude which aforetime were supposed to be the frontiers of the universe it brought to view phalanx upon phalanx, galaxy upon galaxy, rank behind rank whose light had required half a million years to pass the mighty interval. The Milky Way cast away its cloud robes and flamed into a score of million suns; and yet on and on were piled unresolved nebulæ of still more distant outposts of creation.

STARS OF DIFFERENT MAGNITUDES.

Number of stars of the eighth magnitude.

"Of the stars of the first magnitude, which include all the brightest and supposably the nearest stars in the heavens, there are about twenty. Of this number Sirius is so incomparably the brightest as almost to constitute a class itself. The stars of the second class are those in which there is one distinct step downward from the brilliancy of those of the first magnitude. The brighter stars in the constellation of the Great Bear (the Dipper) may be taken as examples. In the entire heavens we have about sixty-five stars of the second magnitude. Immediately below the second magnitude we have the stars of the third magnitude to the number of 190. Next come the stars of the fourth, 425; the fifth, 1,100; and so on down to the sixth, 3,200, which complete the stars visible to the naked eye. In stars of telescopic magnitude we have the seventh, to the number of about 13,000, while the eighth has 40,000, and the ninth 142,000.

"It will thus be seen that the number of stars increases when we approach the lower magnitude, and when we come to those magnitudes below the ninth the number speedily reaches from thousands into millions. The minutest stars visible in powerful telescopes are usually stated to be of the fourteenth or fifteenth magnitude, while in the very greatest instruments magnitudes two or three steps lower can be observed, or to the eighteenth magnitude." *

Thus it appears that as we penetrate the heavens from one magnitude or depth to another the wider disk or area of vision increases the number of stars at the rate of about threefold. Were that the exact as it is the proximate ratio, the number of stars discernible at the greatest depth yet reached by the most powerful instrument would be the enormous sum of about one thousand seven hundred and twenty-one millions two hundred and twenty-one thousand two hundred (1,721,221,200). But actual count up to the stars of the ninth magnitude shows the rate of increase to be much greater as we penetrate to the deeper depths. It is estimated that there are stars visible to the eye whose light has required one hundred and twenty years to reach us. A telescope which penetrates six thousand times that depth would still see a star of the first magnitude were it carried back to that distant point. It thus appears that we reach stars whose light has been tens, perhaps hundreds of thousands of years reaching our planet.

Ratio of increase as we penetrate the heavens.

Chalmers says: "What is seen may be as nothing to what is unseen; for what is seen is limited by the range of our instruments. What is unseen has no limits; and though all which the eye of man can take in or his fancy can grasp were swept away, there might still remain as ample a field over which the Divinity may expatiate, and which he may have peo-

* *Stars of the Heavens*, by Ball, p. 390.

pled with innumerable worlds. If the whole visible creation were to disappear it would leave a solitude behind it, but to the infinite mind, that can take in the whole system of nature, this solitude might be nothing—a small unoccupied point in the immensity which surrounds it, and which he may have filled with the wonders of his omnipotence. Though this earth were to be burned up, though the trumpet of its dissolution were sounded, though yon sky were to pass away as a scroll, and every visible glory which the finger of the Divine has inscribed on it were to be put out forever, an event so awful to us, and to every world in our vicinity, by which so many suns would be extinguished, and so many varied scenes of life and of population would rush into forgetfulness—what is it in the high scale of the Almighty's workmanship? A mere shred, which, though scattered into nothing, would leave the universe of God one entire scene of greatness and of majesty. Though this earth and these heavens were to disappear there are other worlds which roll afar; the light of other suns shines upon them, and the sky which mantles them is garnished with other stars. . . . The universe at large would suffer as little in its splendor and variety by the destruction of our planet as the verdure and sublime magnitude of a forest would suffer by the fall of a single leaf." *

Before we take our leave of the inorganic universe there are still other aspects in which it must be studied. We have viewed it simply with respect to its magnitude and extent in space. Amazing as the results of investigation are on this single aspect of the subject, truth compels the confession that we have not reached the utmost facts. The outer boundary still remains unexplored. Any instruments yet made leave unresolved nebulæ on all the horizon. The vast realms beyond, for aught we know, immeasurably

Outer boundary unexplored.

* *Astronomical Discourses.*

transcend all that has been brought under observation. But there is a limit; somewhere in the illimitable expanse there is a boundary beyond which no world revolves, an outer space where no sun or star lights up the infinite void. The inorganic universe is finite. Research has not come to the border, but there is such a border of creation.

However great must be finite.

Postulate: Even the Infinite cannot create an infinite universe of matter. Whatever has figure or extension must have a limit; and as all collocations of ultimate atoms are reducible by compression into still smaller dimensions the largest dimensions are different from the smallest in size; and all size is finite. Each atom has an identity of its own, which, however compounded with others, it cannot lose. It might forever exist apart and in its own space, and would so exist uninfluencing and uninfluenced but for a force imparted to it or exerted in it which imparts to it influence on every other atom. The atom, in fact, is never found without influence or force of some kind. Within the realm of space in which matter exists there must be a medium for such influence. There is no absolute vacuum.

When we suffer the idea of the universe to unfold itself in the mind the first thought, perhaps, is that of immense extent in space. But this conception is found to be incomplete. Another element in the great idea is found to be demanded. Thus we are led to think of the world in time. A great time is conceived of as corresponding to great space; still the mind is not satisfied. As we have the three dimensions in geometry, so there would seem to be demanded three aspects of the universe, each as the complement of the others, and all entering into the ideal perfection. Thus there comes in still another conception. It is that of degree, of rank, of a rising higher in the order of being. The three dimensions are now complete and the mind is satisfied. We have breadth, we have length, we have

altitude. We have what we have called the *time aspect* of the universe. When the thought has taken full possession of the mind we cannot lose any part of it without feeling that the ideal harmony of the whole has been impaired. There is discord, deformity, and irrationality in the conception of immense worlds in space, having an almost infinitesimal brevity in time. It is the thought of vast breadth without length. There is the same discord, the same unsatisfying incompleteness, when we think of the universe as length and breadth without altitude. As we are not satisfied to regard our world in space as the only space occupied by rational personalities, so neither are we satisfied to regard our world in time, or our *world-time* (*welt-zeit*) as the only world-time to the exclusion of all similar past or to come. And when we have come thus far, equally inharmonious is felt to be the supposition that our own level is the highest altitude of the created universe, or that there are not above us orders and ranks of beings ascending to multiples bearing some ratio, at least, to the descending grades, which we regard as existing below us. It is hard to think that the world ends with our space, that it began with our time, or that its upward growth is bounded by what we may ever so boastingly style our progress. In either of these directions the conceiving faculty stretches on to infinity or toward infinity; and the man of science, in his claim for the human dignity, has no more right to limit it in one aspect than he has to change his theological view with an attempt to amend it in another. We do not say that this feeling is the measure of truth, or that there are these world-spaces, these world-times, and these world-altitudes of being because the mind has a tendency thus to conceive them; yet still we regard it as worthy of consideration in our mental history as we trace its effects in modes of thinking.

Now, to make an application of the general thought, we may say that the first, or space aspect, is the favorite field of mod-

ern science, although she has lately entered upon the second. The third she has, as yet, almost wholly ignored. Scientific men have either said nothing about it or they have shown a tendency, at least, to make man the highest thing in creation next the Deity, and the present state of our world the measure of universal growth.

On the other hand, this first or space aspect is far from being the prominent one in the Scriptures. The Bible tells us nothing about suns and systems and other space worlds like the one in which our own habitation is assigned. Its expression, "the heavens and the earth," comprehends the universe. By the former is meant the visible round mundus which seems to roll overhead. And yet in those reduplications of the terms to which we have alluded, and in such expressions as we find in Psalm viii, 1, "thy glory above the heavens," there might seem to be an aiming at an idea beyond; though whether this world came under the aspect of space or degree—that is, in altitude of supposed upward extent, or of altitude in rank of being—cannot, perhaps, be certainly determined from such passages alone.

In respect, however, to this space aspect of the worlds, and the silence of Scripture about it, there are two common fallacies on which we would briefly dwell. One is that such aspects come wholly from science—that is, modern science. To this it is said we are indebted for our enlarged view of the universe. Now, it requires no great amount of learning or thought to show the falsehood of such an assertion. The idea of the plurality of worlds is full as much an *a priori* as an *a posteriori* judgment. It belongs to all thinking souls, whatever their amount of either positive or hypothetical science. Such a soul of its own promptings asks the question, Has not God made other worlds than this, and made them to be inhabited? We find unanswerable evidence of such thinking among the medi-

tative men of the olden time. The idea of the plurality and even the infinity of worlds can be shown to have been among the speculations of the earliest philosophy. It may have had, with some, more of a metaphysical than of a physical aspect; and yet the thought, in its simplest and most obvious form, comes most naturally to the human mind. Infinite or vastly extended space we long to fill up in some way, if not with worlds like this, at least with exhibitions or exercises of divine power. Why should not God have thus filled it? Why should he not thus have filled one part of space as well as another? If creation is the manifestation of his glory is there not a demand for the thought that this manifestation must have been in spaces and times exceeding our own visible spaces and our own computed times by measures to which no human arithmetic can even make an approach? It may be thought, perhaps, that there is a dangerous tendency in such speculations or in the admission of such a law of thinking as either necessary or natural to the mind. It tends to pantheism, it might be said. It would seem to involve a necessity of creation. But to this there is a prompt and easy answer. Carry our thought to the furthest conceivable extent, and the universe is still finite. We are compelled to admit a time *when* creation is not, and spaces *where* it is not. Carry the objection boldly out to the very conclusion it affects to draw, and such conclusion furnishes its own perfect refutation. If God *must* create, he *must* create everywhere. There could be no vacuum anywhere. And so in respect to time and degree. The idea that the universe is finite in one aspect is no more difficult than the idea of its being finite in the other.

The other fallacy to which we alluded as connected with the space aspect is found in the common opinion that not only the intellectual notion, but the devout feeling, of God's greatness is vastly enlarged by the discoveries of modern science, or what

may be called the mathematical or numerical idea of the universe. Now, in reference to this it may be said, in the first place, that our emotional conceptions are very little dependent upon our speculative or scientific knowledge, as expressed in numerical or quantitative formulas. The reason may follow these to any extent, but the power of conceiving cannot go beyond a certain limit. We have no higher, no greater *conception* of a million worlds than of a thousand, no greater conception of a thousand worlds than of a hundred ; yea, the image or conception which one man has of one hundred worlds may be far inferior in grandeur, in vividness, in power of emotion, to that which another soul has of one. David and Socrates, with no knowledge of the numerical distances or magnitudes of the stars, may have really had a wider, a loftier, a more reverent feeling of the greatness of God's kingdom than Laplace. So may we say one soul may have a more lofty as well as a more devout view of God's greatness at the sight of a mountain than another in the contemplation of planets and comets and nebulæ and double stars, with all their merely numerical or scientific estimations. The reason is that the latter has merely numbers and mathematical formulæ. His soul is upon his calculus instead of the heavens. It would be equally upon it employed to measure the most microscopic distances. We astonish ourselves with long rows of decimals, but no delusion could be greater than that which would make these immense numbers the measure of ideas, much less of the moral emotions connected with them. He who praised God for making "Orion and bringing forth Mazzaroth in his seasons" may really have had a more awe-inspiring view of the universe than the modern lecturer who talks to us of millions and billions and trillions and the wondrous human intellect that can make such transcending calculations in arithmetic. Yet still the stars remain but points for the conception as well as for the eye. The

fancy, too, that peoples them is only a repetition of the world in which we dwell. It is only a numerical enlargement, and even this, instead of being habitually with the mind like the sense of grandeur which has always been connected with the visible firmament, is only fully present while the mathematical formulæ are before it.

The third, or rank, aspect, we have said, is peculiar to the Bible. Science has little or nothing to say about it. The Scriptures, both Old and New, give us no obscure intimations of ascending ranks of being—of angels, of archangels, thrones, dominions, principalities, powers, seraphim, kedoshim, or holy ones, rising higher and higher until the mind is lost in amazing altitude of conceived power and intelligence. See Lewis's *Six Days of Creation*, pp. 338–342.

APPALLING DEPTHS OF SPACE.

In a recent lecture Sir Robert Ball said that a telegraphic message would go seven times round the earth in a second, and if a telegraphic message could be sent to the moon it would reach its destination in a little more than a second. It would take something like eight minutes to arrive at the sun; but how long, think you, would it take to get to Alpha Centauri, traveling thither 180,000 miles a second? Seconds, minutes, hours, days, weeks, months, would not be long enough; it would take no less than three years, traveling all the time at that tremendous pace, before it would reach its destination. If that is the case with respect to the nearest of the stars, what must be said of those which are farther off? There are stars so remote that if the news of the victory of Wellington at Waterloo had been flashed to them in 1815, on that celestial telegraph system, it would not have reached them yet, even if the message had sped at the pace indicated, and had been traveling all the time. There are stars so remote that if, when

William the Conqueror landed in England in 1066, the news of his conquest had been dispatched to them, and if the signals flew over the wire at a pace which would carry them seven times round the earth in a single second of time, that news would not have reached them yet. Nay, more, if the glad tidings of that first Christmas in Bethlehem, nineteen centuries ago, had thus been disseminated through the universe, there are yet stars of which astronomers could tell us, plunged into space in depths so appalling that even the eighteen hundred and ninety-four years which have elapsed since that event would not have been long enough for the news to reach them, though it traveled 180,000 miles in every second. We add, there are now known stars so remote that half a million years would not suffice to convey the message to them.

We cannot better conclude this survey of the inorganic universe than in the eloquent words of our own most eminent astronomer, distinguished alike for his learning, patriotism, and piety, O. M. Mitchell. The excerpt is from his treatise on *Planetary and Stellar Worlds*—a book which deserves a place in every student's library. We know of no more elevating and soul-expanding discussion:

"Having now succeeded in gaining a knowledge of the distance which separates our sun from its remote companions, we are prepared to extend our explorations of the universe. The question naturally arises, how are the stars distributed throughout space?—are they indifferently scattered in all directions, or are they grouped together into magnificent systems? A cursory examination of the starry heavens with the naked eye shows us, that so far as the larger stars are concerned they do not appear to have been distributed in the celestial sphere according to any determinate law; but on applying the telescope that luminous zone which, under the name of the Milky Way, girdles the whole heavens is found to be composed of minute

stars, scattered like millions of diamond points on the deep blue ground of the sky.

"Sir William Herschel conceived the idea that it might be possible to fathom this mighty ocean of stars, and to determine its metes and bounds; to give to it figure, and to circumscribe its limits. It will not be difficult to explain, in a few words, the general outline of the plan adopted by this extraordinary man in the prosecution of this wonderful undertaking. In case we admit that the stars are of equal magnitudes, and at equal distances from each other, it would not be difficult to ascertain how far they extended in any given direction, the one behind the other. It is manifest that, in examining the heavens with a telescope of given power and aperture, we shall be able to count more stars in the field of view in those regions where they are so arranged as to reach farthest back into space; and in case we know their absolute distance from each other, the number counted in any field of view will determine with certainty the length of the visual ray reaching to the most remote star visible in that field.

"Now, although the hypothesis that the stars are of equal magnitude, and are uniformly distributed through space, may not be rigorously true, yet doubtless the mean distances are not far from this hypothesis; and although our results may only be approximate, yet as such they are to be relied upon, and they become the more interesting as they carry us to the utmost limits of human investigation. Armed with his mighty telescopes, Sir William Herschel commenced the stupendous task of sounding the heavens, with the purpose of ascertaining whether the stars composing the Milky Way were unfathomable, or were bounded and circumscribed by definite limits.

"Sweeping a circle round the heavens which cut this grand stratum of star in a direction nearly perpendicular to its circumference, he directed his great telescope to a certain number of points along this circle, and as he moved slowly onward

counted all the stars visible in each field of view. It was fair to conclude that, wherever most stars were to be seen, there was the stratum deepest. Having gone entirely around the heavens, along the circumference of his circle, he had sounded the depth of the stars along a section of the Milky Way, and to obtain the figure of the section thus cut out was not a difficult matter.

"He assumed a central point on paper to represent his point of observation. He then drew from this point lines radiating, and in the actual directions which he had given to his telescope while engaged in his explorations. On each of these indefinite lines he laid off a distance proportioned to the number of stars counted in the field of view in the direction which the line represented, and by joining these points thus determined he formed a figure which represented the relative depths to which he had penetrated into space; and in case he could be certain that he had gone absolutely through the stratum in every instance and had grasped every star, even where the extent was most profound, the figure thus constructed would represent the form of the line cut from the outside boundary of the Milky Way by the plane of the circle in which the explorations had been made.

"Did he then actually penetrate the deepest portions, or any portion, of the Milky Way? This was now his grand question, and to its decision he gave all his power and ingenuity. As a unit wherewith to measure the space-penetrating power of his telescopes, he assumed the power of the human eye, and knowing that stars of the sixth magnitude are within the reach of the unaided eye, he concluded, from the law regulating the decrease of light, that these minute stars were twelve times more distant than the nearest or brightest stars. Now, a telescope having an aperture such as to concentrate twice as much light as the eye would penetrate into space twice as far, or would reach stars of the twenty-fourth order of distances, and so on

for telescopes of all sizes. In this way he concluded that his great forty-foot reflector, with a diameter of four feet, would penetrate 194 times as far as the naked eye, or that it would still see a star of the first magnitude if it were carried backward into space 2,328 times its present distance!

"Such, then, was the computed length of the *sounding line* employed in gauging these mighty depths. Suppose, then, it was required to determine whether this line actually penetrated any given region of the Milky Way. Even with a single telescope, a series of experiments may be performed which go very far to determine this great question. As the space-penetrating power of a telescope depends on the diameter of its aperture, it is easy to give to the same instrument different powers, by covering up, by circular coverings, certain portions of its object glass. Take circles of pasteboard, or any other suitable material, and in the first cut an opening one inch in diameter, in the second an opening of two inches, and so on, up to the diameter of the object glass. These diaphragms, being successively applied to the object glass, give to the telescope space-penetrating powers proportioned to the diameter of the opening.

"In this way Herschel prepared himself to explore one of the deepest portions of the Milky Way. The spot selected was a nebulous or hazy cloud in the sword handle of Perseus, in which, to the naked eye, not a solitary star was visible. With the lowest telescopic aid many stars are rendered visible, surrounded by a hazy light, in which minute glimpse points are occasionally to be seen. As the space-penetrating power was increased, the bright spots of light were successively resolved into groups of brilliant stars, and more nebulous haze came up from the deep distance, indicating that the visual ray was not long enough to fathom the mighty distance. At last the full power of his grand instrument was brought to bear, when a count-

less multitude of magnificent orbs burst on the sight, like so many sparkling diamonds on the deep blue of the heavens. There was no haze behind; the telescopic ray had shot entirely through the mighty distance, and the clear deep heavens formed the background of the brilliant picture.

"Thus did Herschel penetrate to the limits of the Milky Way, and send his almost illimitable sounding line far beyond, into the vast abyss of space, boundless and unfathomable. And now do you inquire the depth of this stupendous stratum of stars? The answer may be given, since we have the unit of measure in the distance of stars of the first magnitude. Light, with its amazing velocity, requires ten years to come to us from the nearest fixed stars, and yet Sir William Herschel concluded, from the examinations he had been able to make, that in some places the depth of the Milky Way was such that no less than five hundred stars were ranged one behind the other in a line, each separated from the other by a distance equal to that which divides our sun from the nearest fixed star. So that for light to sweep across the diameter of this vast congeries of stars would require a period of five thousand years at the rate of twelve million of miles in every minute of time!

"The countless millions of stars composing the Milky Way appear to be arranged in the form of a flat zone or ring, or rather stratum, of irregular shape, which I shall explain more fully hereafter. Its extent is so great as properly to form a universe of itself. If it were possible, to-night, to wing our flight to any one of the bright stars which blaze around us, sweeping away from our own system, until planet after planet fades in the distance, and finally the sun itself shrinks into a mere star, alighting on a strange world that circles round a new and magnificent sun, which has grown and expanded in our sight, until it blazes with a magnificence equal to that of our own—here let us pause and look out upon the starry heavens which now surround us.

"We have passed over sixty millions of millions of miles. We have reached a new system of worlds revolving about another sun, and from this remote point we have a right to expect a new heavens, as well as a new earth on which we stand. But no. Lift up your eyes, and lo! the old familiar constellations are all there. Yonder blazes Orion, with its rich and gorgeous belt; there comes Arcturus, and yonder the Northern Bear circles his ceaseless journey round the pole. All is unchanged, and the mighty distance over which we have passed is but the thousandth part of the entire diameter of this grand cluster of suns and systems; and although we have swept from our sun to the nearest fixed star, and have traveled a distance which light itself cannot traverse in less than ten years, yet the change wrought by this mighty journey in the appearance of the heavens is no greater than would be produced in the relative positions of the person filling an ordinary church near its center who should change his seat with his immediate neighbor!

"Such, then, is the scale on which the starry heavens are built. If, in examining the magnificent orbits of the remoter planets, and in tracing the interminable career of some of the far-sweeping comets, we feared there might not be room for the accomplishment of their vast orbits, our fears are now at an end. There is no jostling here; there is no interference, no perturbation of the planets of one system by the suns of another. Each is isolated and independent, filling the region of space assigned, and within its own limits holding on its appointed movements.

"Thus far we have spoken only of the Milky Way. In case it be possible to pierce its boundaries and pass through into the regions of space which lie beyond, the inquiry arises, What meets the vision there? What lies beyond these mighty limits? Does creation cease with this one great cluster, and is all blank beyond its boundary?

"Here again the telescope has given us an answer. When we

shall have traveled outward from our own sun, and passed in a straight line from star to star, until we shall have left behind us in grand perspective a series of five hundred suns, we then stand on the confines of our own great cluster of stars. All behind blazes with the light of countless orbs, scattered in wild magnificence, while all before us is deep, impenetrable, unbroken darkness. No glance of human vision can pierce the dark profound.

"But summoning the telescope to our aid, let us pursue our mighty journey through space; far in the distance we are just able to discover a faint haze of light—a minute luminous cloud which comes up to meet us—and toward this object we will urge our flight. We leave the shining millions of our own great cluster far behind. Its stars are shrinking and fading; its dimensions are contracting. It once filled the whole heavens, and now its myriads of blazing orbs could almost be grasped with a single hand. But now look forward. A new universe of astonishing grandeur bursts on the sight. The cloud of light has swelled and expanded, and its millions of suns now fill the whole heavens.

"We have reached the clustering of ten millions of stars. Look to the right, there is no limit; look to the left, there is no end. Above, below, sun rises upon sun, and system on system, in endless and immeasurable perspective. Here is a new universe as magnificent, as glorious as our own—a new Milky Way, whose vast diameter the flashing light would not cross in thousands of years. Nor is this a solitary object. Go out on a clear, cold winter night, and reckon the stars which strew the heavens, and count their number, and for every single orb thus visible to the naked eye the telescope reveals a *universe*, far sunk in the depths of space, and scattered with vast profusion over the entire surface of the heavens.

"Some of these blaze with countless stars, while others, occu-

pying the confines of visible space, but dimly stain the blue of the sky, just perceptible with the most powerful means that man can summon to the aid of his vision. These objects are called clusters and nebulæ—clusters when near enough to permit their individual stars to be shown by the telescope, nebulæ when the mingled light of all their suns and systems can only be seen as a hazy cloud.

"Thus have we risen in the orders of creation. We commenced with a planet and its satellite; we rose to the sun and its revolving planets, a magnificent system of orbs, all united in one great family and governed by the same great law; and we now find millions of these suns clustered and associated together in the formation of distinct universes, whose number, already revealed to the eye of man, is not to be counted by scores or hundreds, but has risen to thousands, while every increase of telescopic power is adding by hundreds to their catalogue.

"Let us now explain these 'island universes,' as the Germans have aptly termed them, and attempt approximately to circumscribe their limits and measure their distances from us and from each other. Sir William Herschel, to whom we are indebted for this department of astronomy, conceived a plan by which it was possible approximately to sound the depths of space and determine, within certain limits, the distance and magnitudes of the clusters and nebulæ within the reach of his telescopes. To convey some idea of his method of conducting these most wonderful researches, imagine a level plane, of indefinite extent, and along a straight line, separated by intervals of one mile each, let posts be placed bearing boards on which certain words are printed in letters of the same size. The words printed on the nearest board we will suppose can just be read with the naked eye. To read those on the second, telescopic aid is required, and that power which suffices to enable the letters to be distinctly seen is exactly double that of the unaided eye.

The telescope revealing the letters at the distance of three miles is threefold more powerful than the eye, and so of all the others. In this way we can provide ourselves with instruments whose space-penetrating power, compared with that of the eye, can be readily obtained.

"Now to apply these principles to the sounding of the heavens. The eye, without assistance, would follow and still perceive the bright star Sirius, if removed back to twelve times its present distance. After this, as it recedes, it must be followed by the telescope. Suppose, then, a nebula is discovered with a telescope of low power, and it is required to determine its character and distance. The astronomer applies one power after another, until he finally employs a telescope of sufficient reach to reveal the separate stars of which the object is composed, which shows it to be a cluster; and since the space-penetrating power of this instrument is known, relative to that of the human eye, in case the power is one hundred times greater than that of the eye, then would the cluster be located in space one hundred times farther than the eye can reach, or twelve hundred times more remote than Sirius, or at such a distance that its light would only reach our earth after a journey of one hundred and twenty thousand years!

"Such was Herschel's method of locating these objects in space. Some are so remote as to be far beyond the reach of the most powerful instruments, and no telescopic aid can show them other than nebulous clouds of greater or less extent. It was while pursuing these grand investigations that Herschel was led to the conclusion, that among the nebulæ which were visible in the heavens there were some composed of chaotic matter, a hazy, luminous fluid, like that occasionally thrown out from comets on their approach to the sun.

"Among these chaotic masses he discovered some in which the evidences of condensation appeared manifest, while in others

he found a circular disk of light with a bright nucleus in the center. Proceeding yet farther, he found well-formed stars surrounded by a misty halo, which presented all the characteristics of what he now conceived to be nebulous fluid. Some of the unformed nebulæ were of enormous extent, and among those partially condensed, such as the nebulæ with planetary disks, many were found so vast that their magnitude would fill the space occupied by the sun and all its planets, forming a sphere with a diameter of more than six thousand millions of miles. Uniting these and many other facts, the great astronomer was finally brought to believe that worlds and systems of worlds might yet be in the process of formation by the gradual condensation of this nebulous fluid, and that from this chaotic matter originally came the sun and all the fixed stars which crowd the heavens. This theory, extended, but not modified, in the hands of Laplace, is made to account for nearly all the phenomena of the solar system.

"For a long time this bold and sublime speculation was looked upon, even by the wisest philosophers, with remarkable favor. The resolution of one or two nebulæ (so classed by Herschel), with the fifty-two feet reflector of Lord Rosse, has induced some persons to abandon the theory and to attempt to prove its utter impossibility. All that I have to say is that Herschel only adopted the theory after he had resolved many hundreds of nebulæ into stars; and if there ever existed a reason for accepting the truth of this remarkable speculation, that reason has been scarcely in any degree affected by recent discoveries.

"I have examined a large number of these mysterious objects floating on the deep ocean of space like the faintest filmy clouds of light. No power, however great, of the telescope can accomplish the slightest change in their appearance. So distant that their light employs (in case they be clusters) hundreds of

thousands of years in reaching the eye that gazes upon them, and so extensive, even when viewed from such a distance, as to fill the entire field of view of the telescope many times. Sirius, the brightest and probably the largest of all the fixed stars, with a diameter of more than a million of miles, and a distance of only a single unit compared with the tens of thousands which divide us from some of the nebulæ; and yet this vast globe, at this comparatively short distance, is an inappreciable point in the field of the telescope. What, then, must be the dimensions of those objects which at so vast a distance fill the entire field of view even many times repeated?

"Herschel computes that the power of his great reflector would follow one of the large clusters if it were plunged so deep in space that its light would require three hundred and fifty thousand years to reach us, and the great telescope of Lord Rosse would pursue the same object probably to ten times this enormous distance."

TIME MEASURES OF THE UNIVERSE.

THE mind does not rest with the discovery of these vast masses and their vaster distances from each other in space, and their interrelations of motion and harmony, amazing as these discoveries are. One set of facts discovers another.

Pushing its inquiries still further, it discovers, not simply that they are composed of similar substances, and what these substances are, but, deeper yet, what their primordial condition has been, and by what process they have been brought into their present condition.

In conducting the inquiry it returns to the study of the objects immediately about it, the study of the earth itself. It has given the name matter to the substances of these marvelous masses it has been contemplating; it now returns upon its track to find out what this matter is and the variety it manifests.

Here we begin our study, and that we may not fall into aberrations of fancy we will call to our aid the definitions supplied by the ablest scientists, and the conclusions now universally admitted to be true and reliable.

Matter is a substance which has form and which occupies space and which is impenetrable, that is, which precludes any other substance from occupying the same space which it does. In its final forms it is an atom.

The earth is a body which consists of innumerable atoms. All masses or worlds are simply accumulations of atoms, held in fixed relation to each other, so as to constitute a unit in space marked off by distance from other similar masses, and so as to have an economy of its own.

From these accredited facts of science we postulate as the primary stage and most primitive form of matter the ether which is found pervasive of the entire universe, a simple and uncompoundable substance, which, as an ocean whose boundaries extend to the inclusion of all other material substances, touches and relates every other atom of every other substance, connecting the interstellar spaces and all spaces of the universe together.

The ether.

This most primitive form of matter is also the most attenuate; the atmosphere is gross compared with it. It bathes the sides of all atoms in the densest solids and interpenetrates the atoms of impalpable gases themselves. It is the universal frame in which all atoms are set, parting every one from every other, and binding all together. All worlds revolve in it; it is the highway for light and the electric fluid, and for gravitation itself; the invisible and imponderable forces travel it as they bind the spheres together and exert their power upon them. If there is such a substance as ether it has no resemblance to any other of the sixty-two substances of matter except occupancy of space and figures as a whole. It is not ponderable; it is not compoundable with other substances; it is not drawn toward a center by gravitation; it exerts no influence; it has no affinities; and yet it may furnish the condition of the existence of every other substance and of the forces exerted by them or in them.

The primordial condition of all other grosser matter was that of atomic severance, each atom existing apart by itself in its own place, neither compounded with nor affected by its neighbor, any more than if it were alone the universe.

An atom, though reduced to infinitesimal dimensions, so as neither to be palpable nor visible, is a reality—has the quality of individual being in it; and if there be collocations and com-

pounding of atoms into masses they must first exist as distinct and separate entities. The one involves the other. Atoms are antecedent to masses, and masses are resolvable into atoms.

The atom.

All atoms, that is, all matter in whatever state, are characterized by a certain number of common properties, which, being universal, are essential. No atom does or can exist without them; no atom can be deprived of them. Where they are not found matter does not exist. These universal properties are extension, figure, impenetrability, indestructibility, inertia, where atoms become massed; divisibility, paucity, compressibility, expansibility, mobility, and gravitation are also discovered to have been potential properties of all atoms.

In mass matter assumes one of three possible forms: solid, liquid, or aeriform; solid when the atoms cohere so that they cannot move among themselves; liquid when its particles do not cohere, but move freely among themselves, as water; aeriform when it exists as atmosphere, or gases, or vapors.

There are known to be sixty-two differentiable kinds of atomic substances possessed of these common properties. Of these fifty are distinguished by a peculiar luster and are called metals. The others are distinguished as nonmetallic. The nonmetallic elements are oxygen, hydrogen, nitrogen, chlorine, iodine, bromine, fluorine, selenium, sulphur, phosphorus, carbon, and boron.

These original substances are called simple, for the reason that they cannot be resolved into more than one element, though they may be compounded with some of the others.

Matter as we know it is rarely found in the simple form; the atmosphere is compounded of twenty-one parts of oxygen and

seventy-nine parts of nitrogen. Water is also a compound substance, having one part of oxygen to eight parts of hydrogen.

These sixty-two differentiable substances are not all equally distributed over the surfaces of the earth or in the masses of matter in world forms. Many of them are extremely rare, and discoverable only by most careful and delicate processes of investigation. Of the whole number ten or fifteen only are found in the great bulk of the objects or collocations with which we are familiar. We have already stated that the atmosphere is compounded of but two of them, and also that the same is true of water. The great masses of rocks and earth are mainly composed of eight, and easily reducible to them, namely, oxygen, which is the principal constituent of universal matter, silicon, aluminum, calcium, potassium, sodium, chlorine, and iron.

These original or simple substances, which in the ultimate form are all alike atomic—that is, exist as atoms—are found to be undergoing incessant changes—changes of place and relations; changes of composition and decomposition; changes of condition from hardness, or solids, to fluids, and from fluids to gases, and back again; changes of temperature from hot to cold, and the reverse; changes of motion and mass, of texture and form, of taste and odor and color.

Changes of atoms.

The changes are traceable to causes to which we give the name of forces—we call them natural forces, and mean thereby that they somehow belong to the nature of these substances, and must therefore under given conditions occur. When the conditions are found under which they are sure to exist we call them laws.

Forces are not substances. They have none of the properties of substances, as length, breadth, and thickness, or form or divisibility. They do not occupy space. They act in and on matter, but are not matter or essential to the existence of

matter, though always appearing in matter. Ultimately all forces are a mode of agency. Forces are differentiable modes of action. It is possible to conceive of matter—that is, atoms—existing without affinities or motion of any kind; but it does not so exist. If atoms existed without the forces it would be simply as an infinite expanse, a useless immensity of mere stuff. It would exist to no end.

The forces are few and simple: they are attraction of gravitation and molecular forces.

The name gravitation is applied to that force by which all the bodies or atoms of the universe attract or tend to approach each other. It differs from all molecular forces in that it is universal and constant under all conditions; acting at all times, upon all substances, and at all distances. It is that master force which binds all atoms together and regulates the motions of worlds, from which there is no escape—that force by which all atoms are drawn toward some center. It acts instantaneously. It treats all matter alike. Its only variation is that it increases with the increase of the mass, and diminishes as the square of the distance increases. Formulated it reads: a force which acts in proportion to the mass, and which becomes less as the square of the distance.

Molecular forces differ from gravitation in that they act internally upon particles of matter when the particles are in close proximity, and only under such conditions. They are modes of interaction among contiguous atoms. The forces developed through the agency of heat (which is a state of some material body) and light, electricity and magnetism, are diverse in their nature and affect different forms of matter differently. They differ from gravitation inasmuch as their influence is not universal and constant, but local and limited both in time and space. They differ also from molecular

Forces.

forces inasmuch as their influence is exerted at measurable distances, though not at great distances.

Molecular forces are found under four manifestations or varieties: cohesion, adhesion, capillary attraction, and affinity.

Cohesion is that form which binds together atoms of the same kind to form a compact or uniform mass, and differs from gravitation, which draws all kinds into a common mass; the force which holds together atoms of iron, stone, or other coherent masses. By cohesion the constituent atoms are not destroyed, but united, cemented.

Adhesion is another form of molecular force which causes unlike substances to adhere, but not unite, as smooth surfaces cleave together.

Capillary attraction is a form of molecular force. It manifests itself variously between the surfaces of solids and liquids.

Affinity is a mode of molecular force precisely the reverse of cohesion, and next to that most efficient to the conversion of atoms into masses. As cohesion binds together atoms of the same kind into solid masses, so affinity binds together and unites into solid masses unlike substances. The resultant is not mere mass, but a compound which manifests different qualities from any discoverable in either part separately. The compound is thus seen not to be a mere mixture of different parts, but a transfusion or interblending, making a third something not in bulk merely, but in a different class of properties. Water is not oxygen, nor yet hydrogen, nor a mixture; but a substance with new properties belonging to neither. Thus it appears that the action of gravity and the several molecular modes of force differ in their manifestation and results. The force of affinity binds together the atoms of the elements oxygen and hydrogen to constitute a molecule of water. Cohesion unites the molecules thus formed into a drop or an ocean. Adhesion causes the union of water with the surfaces of different substances. Capil-

lary attraction causes water to rise above its level; while the force of gravity causes coherent quantities of water to descend in rain from the clouds, or to move down inclined planes as rivers until they find their level.

Having now possessed ourselves of the knowledge of the vast masses of inorganic substance aggregated in worlds, and of their distribution through immeasurable regions of space; and having discovered that these masses are composed of innumerable atoms of such infinitesimal dimensions as to require the aid of the microscope to render them visible; and having found that these atoms are of sixty-two kinds of differentiable substances variously impacted and compounded; and having ascertained the forces which act in and upon them to produce the various changes through which they have passed and are passing to bring them to their present conditions and relations, we are prepared to consider another aspect of the inorganic universe, namely, its temporal measures, or the method by which it has been brought to its present state and the length of time consumed in bringing it to its present condition.

By the essential properties of the atom we were enabled to determine with the utmost certainty that, illimitable as it is, space occupied by matter is nevertheless finite, boundable, and actually bounded, though its utmost bounds are not ascertained or ascertainable by any powers within our possession or reach. No certainty of knowledge is greater or more secure than this, that out beyond whatever is figurable or has figure as its essential property there is an unfigurable immensity or infinitude of space where matter might exist. There is a center and circumference of all matter substance, and its diameter, though unmeasured, is measurable. This we postulate as a necessary truth, reached not by observation but by intuition.

The universe bounded.

The question whether it is also finite or limited in its time measures is that which we now raise. It is confessedly the most difficult problem in the whole range of scientific investigation, and also the most important in its theological bearings. As a scientific question it must be treated in the light of known facts, and must be subjected to the tests which determine facts to be facts. A class of thinkers arrogating to themselves the appellation of scientists assert that all original inorganic substances are eternal, and that all subsequent changes are products of their inhering forces. Another class as positively affirm that all such substances had a beginning and were created, and that all subsequent changes are outcomes of the agency which produced them. The first position leads to atheism; the second affirms theism.

What are the known facts in the light of which these antagonistic affirmations are to be tested? It were an easy thing to appeal to the Bible and say that it settles it, and so to refuse further inquiry. But this summary method, however it might satisfy some minds, fails to give content to others, who imagine that facts contradict it. Facts must be the court of last appeal, since no assumption can stand against them.

Light.

The first fact to which we need to attend is this: that we have no knowledge of the actual origin of any atom of matter. This is a universally admitted fact. Of the beginning of matter as a whole, or of any part of it, we know nothing, either by observation or induction or intuition.

Beginning of matter.

The second fact we call attention to is this: whether inorganic substances had a beginning or not, we know as a fact that it does exist, and has existed through immeasurable ages of time, and we are able to trace the history of changes in it throughout these vast eons to what seems to be its most primitive—actually

primordial—condition. This we affirm to be a fact, and one of great importance in its bearing on the question under consideration, and now ask attention to its proofs. The first proof we submit is drawn from the observation of the heavenly bodies.

It is established by indubitable evidence deduced by many actual experiments of the most unquestionable accuracy that light is subject to the law of motion, if it is not in fact a mode of motion, and hence that it occupies appreciable time in its passage through space. If any fact is absolutely determined, this is. The existence of the sun is not more certain than that it requires about eight minutes for its light to pass over the space which separates it from the earth. The movement is determined at about one hundred and ninety thousand miles in a second of time. This is not the place to recite the evidence which supports this fact; nor is it necessary. The eye discerns stars whose distance has been measured with mathematical accuracy, whose light requires a hundred and twenty years to cross the space separating them from the observer who beholds them. The telescope, with a penetrating power many thousand times that of the eye, reveals stars whose light has required two hundred and fifty thousand years to reach the eye of the observer, and unresolved nebula out beyond whose light has required double that time to make the transit. No one who is informed will doubt these facts. They fall far within the limit of reality. The ablest and most devout astronomers have affirmed that the inorganic universe, under actual observation by means of instruments, is of such extent that its diameter would require millions of years for light to traverse. The processes by which these conclusions are reached are open and within the reach of all studious observers.

Time measures of light.

The fact thus established by careful scientific method determines that the universe as existing with developed solar bodies has been as it now is for not less than a million years. How

much longer we do not conjecture, nor does astronomic science give any clew.

Nor does the fact here adduced simply prove the measureless antiquity of those distant stars, or, more properly, suns. The evidence is that our own sun, whose light comes to us in eight minutes, has been sending forth its beams to these far-off worlds during the same period—is, in fact, of the same antiquity with the most ancient of its compeers. It matters nothing what the theory of light is—the result is the same. This appears from two facts: first, the harmony of the spheres and their fixed relations, and the great universal law of gravitation which determines their relations. Second, from the fact that its existence is traceable in its effects on our planet, both as to its inorganic changes and its organic phenomena, to a period much more remote than that required for the transit of light across the longest diameter of the known stellar universe. Nothing is more certain than that it was needed to be in its place contemporaneously with the existence of our planet itself, and that its solar function was needed in the earliest ages of organic existence.

Harmony of the spheres.

Our next proof is deduced from the science of geology. This science treats of the earth. It is relatively recent, but it has rapidly grown into one of the best understood branches, and now takes rank almost as one of the exact sciences. Its facts lie so within easy reach that they fall under immediate observation, and cannot be disputed. It deals with forces and agencies, and the effects which they produce, which are now in full play under our direct cognizance. Its facts are numerous and open, and the knowledge of them is increasing with every sun rising and setting. We now call attention to some of those well-known facts which point to the immense antiquity of the earth as an inorganic mass, or prior to the ages of life.

Ages of geology.

Had the earth from the beginning been as we now find it, and remained a perfectly unchanged body, it is difficult to see how it would have been possible to get at any clew to its age; indeed, it would have been impossible. The immutable gives no note of time. Changes denote time and forces which produce them. When the forces are known, and the conditions under which they act, and the relative time consumed in the effects, we are able to arrive at a proximate estimate of the whole period during which all the observed effects were wrought.

To ascertain the changes through which the earth has passed we have to begin our researches with those which we observe and the causes which produce them. These changes are those which take place immediately upon its surface, extending to but a few inches beneath. Below that by actual observation we know absolutely nothing. But while we do not see below the surface so as to note what is passing there, we shall be able to show by many indubitable evidences that changes have been passing there through immeasurable ages of time. We shall find the same forces which are now working changes under our eyes were working long ago just as now, when portions of the earth which are now miles deep below the surface were the then surfaces of the world.

The agencies now working changes upon the surface may be named: gravitation, cohesive attraction, chemical affinity, changes of temperature, the heat of summer and cold of winter, erosion of rocks by chemical and mechanical agents, action of the atmosphere, organic growth and decay, rains, snows, currents of rivers and streams, the beating of ocean tides and waves on their shores, cloudbursts and inundations, earthquakes and volcanoes, uplifts and depressions of continents, windstorms, mechanical attrition, glacial slides and movements, geysers, springs, organic agencies, solar influences of light and heat. These forces are now at work uninter-

Agencies of changes.

mittently about us on every hand, often unnoted and always unappreciated, except by the few who carefully study their operations. The crust of the earth reveals evidences that the same forces have been busy along all the ages of earth's history, in more active and terrific forms as we descend to the period of their earlier and earliest manifestations. Most conspicuous among them is gravitation, chemical affinity, cohesive attraction, fire, and water.

There have been periods extending through ages in which they were intensely active, producing the mightiest changes, ruptures of the earth's surfaces, cataclysms, and upheavals, evidences of which, as we shall see, remain to this day.

Their operations are now quiet and orderly, and their effects only observable in local and transient changes. From year to year and generation to generation, and indeed throughout historic time, there has been scarcely any marked change in the visible condition of the earth. The mountains and oceans and rivers and continents and islands are essentially the same as when man first made observation of it. The climatic changes are small; the contour of land and water, the vegetable and animal tribes, the mountain ranges and river courses, the forests and lakes, are the same our most ancient ancestors looked upon. The same birds sing in our groves, and the same fishes swim in our seas, and the same animals roam in our forests. It is the same earth our ancestors back to our primogenitor inhabited in all essential respects, modified only by the touch of man. The same stars shine above us in their exact places that guided and cheered the shepherds of Chaldea as they herded their flocks on the same slopes and in the same vales where their descendants live and toil to-day. Kingdoms have risen and passed away, civilizations have come and gone like shadows over the rocks, man's works and monuments have perished, but the earth remains in its old orbit and turns its surfaces

to the sun unchanged through these human ages; and yet great changes have been going forward even during this period, some of which will be noted.

Changes are the records which the earth makes of its history. They tell the story of its age and of its experiences. The record is often blurred and parts totally effaced, but enough is preserved to enable us to trace the story from its beginning to the present, and read backward and forward the romance of its youth and middle age all through from infancy to majority without the loss of a single chapter. "It is lead in the rock forever;" more marvelous than the wildest dream of fancy, yet as real as the rocks in which they are traced and as determinable in the agencies which produce them and in their chronological order as the pages of a written history. As to read a book one must master the alphabet, so to read this ancient volume one must acquaint himself with the facts.

Having observed the forces working about him and looking full upon the varied surfaces of the world all abroad, he begins to inquire the relations of the one to the other. Here is a vast region broken up into mountains; adjacent is half a continent of rolling lands and stretches of plain; here are great gorges and ancient beds of living or extinct rivers; here are conical shafts thousands of feet high with dead craters in their summits and clay and lava accumulations along their sides and out into the plain about their bases leagues in extent; over half a continent are scattered great bowlders and immense rocks weighing thousands of tons, separated from their congeners or native habitat. Everywhere over all the world are beds of gravel and rounded pebbles and bowlders piled up into hills hundreds of feet high; along the sides of the mountains are striated rocks laminated in regular layers piled one upon the other; along the ocean and lake and river shores are beaches, one, two, three,

of accumulated rocks and soil, pointing unmistakably to ancient sea levels; there seem in some places, hundreds of miles in extent, substructures of walls laid as if in masonry; the materials of which the walls are built are filled with casts of organisms which resemble creatures which now live; here are vast measures of combustible rocks,-many feet in thickness, and lower down, separated by other rocky strata, another and then still another and then still another; down beneath all is a vast crystalline base upon which the mighty accumulations are piled.

The outcome of research is this, that these facts discover changes which have been passing in this outer crust of the earth through infinite ages, by the operation of the forces which are still, but more quietly, carrying on their processes to-day; forces building and destroying the continents.

Let us see if the history can be deciphered and the time, orders, and measures be determined.

How were the mountains piled? By the agency of internal fires. How were the plains formed? By sedimentation in ancient seas and lakes and the attrition of the elements leveling elevations and filling up depressions, and by the deportation of comminuted substances by wind and water. How were the pebbles and rounded bowlders fastened? By being rolled in currents and waves. How were the stratified rocks piled? By deposits in ancient seas, lakes, and oceans deported from the dry land. How were the bowlders deported from their ancient homes and sown broadcast over the continents? By emptyings of frozen oceans over the continents. How were the coal measures corded under the rocky strata which hide them away? By uplift of continents which grew the prolific vegetation of which they are composed, and then by depression under shallow seas and ocean waters until superincumbent rock strata were laid down upon them, and so by repetition

until the series was complete. There is now no question among those who have patiently studied these phenomena about the correctness of these findings.

That the mountains were reared by the agency of heat has, I believe, never been questioned. They are either volcanic in their origin and simple accumulations of substance spouted from internal depths, or ruptured masses, lifted and piled in jagged ridges and peaks by continental upheaval. Both agencies are perfectly apparent and differentiable. If we add to these the agency of water floods poured from the clouds, and through the ages dashing down their sides in torrents and rivers, cutting deep gorges therein, we have a full account of their origin and outline.

That the stratified rocks were made by sedimentation is proved by their structure and fossil contents, and by the visible operation of the same cause now. That the great bowlders were floated to their places by rushings of emptying oceans and by masses of icefloes is evident from the fact that striæ and moraines show that they were dragged or driven along lines of movements.

That pebbles were factured by being rolled in currents and waves of water is proved by the fact that the process is going on to-day in all river and lake and sea beds and shores, and from the fact that no other method of their formation can be assigned, and from the further fact that their surfaces show that they were ground from other shapes into their rounded form. The force which formed the mountains is less capable of being measured, and less calculable as to the time required for the effect, but there are not wanting means of proximate calculations. Volcanic agency, though rapid when in highest activity, requires time for its effects. Upbursts may be instantaneous, but when we consider the vast ranges of mountains on all the

continents, and beneath the oceans as well, apparently breaking up the entire crust of the globe, we are compelled to locate the agency causing such effect long anterior to the age of life on the planet, and during the formative period, antecedent to the secondary, or sedimentary crust, or to any subsequent upheavals, breaking the strata piled upon them, and in no way active in the formation of the secondary rocks.

Secondary rocks.

The force which has been operative in the production of the secondary rocks, or rocks made by sedimentation, is almost, if not entirely, aqueous. The mode of its operation is gradual, and, though at times violent, usually relatively quiet. It acts in the form of solution, or decomposition, and deportation. The loose or decomposed elements are taken up by it and deported and deposited in thin and proximately equal horizontal layers along the courses of rivers and their overflowed banks, and out in basins, lakes, and seas, into which the rivers empty, or in which they are held in solution from the bottom of the ocean. Before there were continents of dry land, but after water had formed, sedimentation may have commenced building at ocean bottoms. When portions of the crust were lifted above the watery enswathement a decomposing agency immediately began to grow upon the solid crust, just as at present. Chemical and atmospheric action began to weather the crystalline mass and loosen its particles, and the descending rains forming into rills and rivers caught up the portable parts and carried them in solution, dropping them in the flow, but carrying their more portable or finer parts out into the basins where the water emptied itself, and dropping them over its floor. Thus the stratified rocks were made; they are being so made now.

Mountain changes.

The general cause of mountains (as indeed of all igneous phenomena) is the reaction of the earth's hot interior upon its cooler crust. Mountain chains seem to be produced by the secular cooling and therefore contracting of

the earth, *greater in the interior than the exterior*, in consequence of which the face of the old earth is become wrinkled. Or, to express it a little more fully, by the greater interior contraction the exterior crust is subjected to enormous lateral pressure, which crushes it together and swells it upward along certain lines, the strata, by the pressure, being at the same time thrown into more or less complex foldings. These lines of upswelled and folded strata are mountain ranges. The first grand forms thus produced are afterward chiseled down and sculptured to their present diversified conditions by means of aqueous agency.*

Now it remains to examine the result and calculate the time occupied in bringing it about. Our only search now is after the time measures of the process. We are not at all preparing an examination of other questions which pertain to geology. For this the reader must refer to scientific treatises such as Dawson's *Earth and Man*, Winchell's *Walks and Talks in the Geological Field*, *Elements of Geology* by Le Conte. This latter book is exhaustive and most able.

A word before we trace the process, that we may be prepared for the examination. We have been so long accustomed to imagine that the earth and heavens were made and completed in a brief time, and by direct agency, that we need to remember a few facts which have been already hinted at before we advance to the consideration of matters now to be introduced.

We have already called your attention to positive proof that instead of a brief time millions of years have been employed in the formative work of the universe. This point is established already by the discovery of the time consumed in the transit of light from the remotest nebula brought under observation by the telescope. It is no more a question.

* See Le Conte's *Elements of Geology*.

We now adduce other facts which require the supposition in order to their explanation. You are prepared, therefore, to admit vast ages of time, to explain phenomena, and will not be disturbed when we assume it as already established, while at the same time we point out processes which not only require such immense periods, but also demonstrate the fact. When we are freed from the delusion that time history is short, and are ready to concede an immense period to it, we shall be able to deal with the facts which we encounter in the study of the earth. When we discover phenomena that under the normal operation of the forces by which they were apparently produced required millions of years, having found absolute proof that the history has been developing through such measures, we will not find occasion to reduce the period to a less measure.

Had the earth been created a globe of matter substantially as we find it in respect of distribution of land and water, and in the elements which compose it, so that the ancient seas had always maintained their places and the dry land had also occupied the same position it at first held, the principal phenomena in its crust, could they be discovered, could not be explained, nor would it be possible for many of them to exist, and also there would be no means of arriving at its probable age, or even to determine that it had existed more than a brief period as compared with geological eons. Its dry land, which can alone be examined, would have presented no such appearance and no such facts as are now presented. There might, indeed, have been mountains lifted by internal fires, and deep gorges and river beds cut through soils and rocks by the action of rains, and slight surface changes produced by chemical agents and other surface effects, but there would have been no accessible stratified rocks to tell the story of the ages of their formation and varied conditions under which they were made ; or fossil contents revealing the history of life ; or coal measures serviceable

to the uses of man; or indeed any of the phenomena which we now perceive, except possibly those of volcanic origin and those produced by atmospheric, organic, and aqueous agency in forming the soils and in furrowing the surface into river beds. All stratification would have been carried on under the oceans and seas, and we should not, perhaps, even have dreamed of their existence; the supposition itself, though long entertained, is beset with other insuperable difficulties. The proof, as we shall see, is that the history has not been that. The earth is, indeed, the same as to its substances and forces, but the proof is that in respect of size and surface phenomena it has been the scene of perpetual changes, dry land and oceans often changing places, and inorganic and organic changes chasing each other over immeasurable ages.

But had the two portions remained unchanged, land where the land was first placed, and water where the water was first placed, and the quiet forces left to work their effects, this would have been one of them: the dry land would have been constantly lowered until it came to the water level and became submerged, or it must have been constantly uplifted so as to preserve its relative level. In either case we should have found it impossible to determine anything of the probable duration of the process, and carbonifera would have been impossible.

This further result would have followed: there would have been a perfect series in their exact order of stratification under the oceanic waters, each geological period depositing itself upon that which immediately preceded.

Allowing, as we now find it, that there was a long period during which there was no life upon the planet, could we get a cross section of the deportations into the sea, or sedimentation by the sea, we should have a corresponding stratum, in which there would be no fossils, there being no life or organic remains. Allowing the history of ages of life to have been just

as it has been, we would then find overlying this forty thousand feet of unfossiliferous rock the complete series of strata up to date. Following the unstratified igneous foundation would have been the metamorphic deposits, formerly known as the primary azoic period, but now, as more comprehensive, the laurentian system and archæan era; ascending into the first forms of life, called by Darwin and others the eozoic age. Then we should find without a gap or break the complete paleozoic era; comprising in their order the silurian system—lower and upper—the devonian, the carboniferous, the permian. We should then have what was formerly known as the old tertiary, but modernly called mesozoic age, comprising cretaceous, jurassic, and triassic formations. Then, rising to the most recent geological period, we should find neozoic deposits, eocene, miocene, pliocene, postpliocene, modern—the quaternary group.

But, as we shall see by irresistible proof, such has not been the history of the earth. The continents have not always been continents, or the oceans and seas always oceans and seas. They have many times changed place. Present seas and oceans roll over many buried continents, or parts of continents, whose memorials we cannot reach. Present continents have been many times and for long ages submerged. It may be allowed as probable that the present continents and oceans occupy substantially their primitive position, the oceans often engulfing parts of the continents and uplifting other parts that had been submerged. It is this series of changes that puts us in possession of the earth's story. The records were made under the waters for the most part. We are able to trace the writing by having the once submerged page lifted up and spread out on the dry land, portions of it being found here and portions yonder, and possibly large portions entirely lost.

Let us see how this is; and that it is. We have already

referred to the stratified rocks and to the fact that these were laid in the waters. Before we proceed more particularly to examine the story they relate we now call your attention to the fact that there are more ancient unstratified rocks, upon which they are built. Of these more ancient rocks we shall speak further on, and how they came and the story they tell. For the present we assert that all stratified rocks are laid down on unstratified bases. Stratification, therefore, marks a line of new facts in the history of world growth, and like the annular rings of trees, or physiological changes in animals, records growth and age.

Stratification.

Stratified rocks, we have said, are made in water by deportation of material and by sedimentation found in solution *in situ*, but chiefly by the former. This is a well-known and universally conceded fact. The sedimentation is affected by the extent and force of agitation and volume and swiftness of currents, and coarseness or fineness of material deposited. In quiet waters the texture is attenuate and the laminæ fine grained and evenly laid; in turbulent waves or currents coarser and more irregular in volume and form. The growth is constant and gradual, and, as to age, determinable by measurable agencies employed in their production, and by their nonfossiliferous or fossiliferous contents. Any portion of the earth's crust that may at the time be submerged either under shallow swamps or lakes or estuaries, or under deep seas, may be recipients of sedimentation, and the sediment is determinable whether laid in fresh or saline waters. No portion of the earth elevated above water becomes stratified, but is always subject to waste and denudation, both by the action of wind and rainfalls and other causes. Wind waves over naked plains and higher lands transport loose and fine sands and pile them in heaps which simulate stratification, but are easily distinguishable; but this effect is mainly confined to

seashores where immense drifts accumulate. The overflowing of rivers, inundating vast marginal bottom lands, leave deposits which in the course of ages increase into many feet of earth.

In these various ways stratified accumulations are piled on the primitive foundations of the world. The extent of these changes indicates the time measures of world growth since the solid crust was formed.

But now, before we come to examine the result in this direction, let us turn to examine how the primitive crust itself is formed, and see what light it sheds on the question of the time measure of world growth.

If the unstratified under floor on which the stratified rocks are piled may be supposed to have been made instantaneously, the age of the world would be simply the time consumed in the piling up of the stratified deposits; but if time was also consumed in making the primitive substructure, that must also be considered, and it may appear that an immeasurably greater time was consumed in this first stage than in the second.

Unstratified under floor.

It is entirely certain that the unstratified antedate the stratified rocks, and that the latter are made out of the former by disintegration and deportation. This needs no proof. Is there any way by which we can determine how these older forms were produced, and whether instantaneously or by long process?

There are abundant facts which give light on this subject, and to some of these we now call attention.

The unstratified are distinguished from the stratified (*a*) by position; (*b*) by the absence of true stratification; (*c*) by a crystalline structure; and (*d*) by a total absence of fossils.

They give evidence that they have been consolidated from a fused or semifused condition, and are hence called igneous rocks. This origin is clearly shown by their structure and by

the occurrence in them of dikes and tortuous veins, and by the effects produced on contactual stratified rocks, and by their likeness to lavas. They underlie the strata wherever found over the whole globe, and reach as far down as can be penetrated toward the interior of the globe; they form the peaks and apexes of mountain ranges, and fill the fissures and veins of fractured overlying stratified rocks, into which they could only be introduced in a state of fusion. These universal characteristics lead to the conclusion that the globe itself was primitively a molten mass, of which the exterior was formed into a solid crust by radiation of heat and refrigeration.

This theory finds support in these further facts: (*a*) by the oblate spheroidal form of the earth; (*b*) the baked, wrinkled, contorted, and semicrystalline condition of the stratified rocks immediately overlying the unstratified base all the earth over, except when the strata is of a much later age—the oldest strata are invariably transformed by evident heat agency; (*c*) the volcanic phenomena found in all parts of the globe even to this day; (*d*) the increase of temperature as we descend in the crust, showing that at a fixed depth all substances would be reduced to a molten or fluid state; (*e*) earthquake phenomena; (*f*) the known constitution of the sun; (*g*) but more than all, the elliptical form of the globe itself.

For a more complete examination of this subject the reader is referred to any respectable scientific treatise in geology, but especially for its fullness and fairness to Le Conte's great work, in which all theories are stated and all related facts considered.

Whether the earth is or is not at present a molten mass to its center, it is certain that it has been from the beginning, and is now, greatly affected on its surface by igneous agency from within, and that its most primitive floor was consolidated from a molten state.

But we are not permitted to suppose that we have reached the real beginning of earth history when we find it a molten globe of the dimensions it had when it began to form its solid crust. There is abundant evidence that even after it had come to such a density as to begin to solidify at the surface, it continued to shrink; and we are pointed back to a time when it was a much less compact mass than when it received its relatively fixed form and size. While the nebular hypothesis cannot be put forth as absolutely scientific, it is supported by so many agreeing probabilities as to justify its acceptance as a working theory; we cannot pass, therefore, without stating it and pointing to its bearings on the problem of time as involved in universe or world making. It has the earmarks of truth, and in no way diminishes, if it does not augment, the glory of the creative method. The least that can be said of it is that it seems more rational than any competing view, while no fact can be alleged against it.

It assumes, and with certainty of correctness (so far), that the primary condition of world substance was the atom of which worlds are composed. Nothing is more certain than this postulate. Its next assumption leaves room for doubt, since it is not absolutely proven, but only reduces to probability; that assumption is, that the atoms to become the future constituents of worlds were primarily diffused through the space which was to be the future place of the worlds to be built of them, and now occupied by them. It assumes then, third, that these widely-disseminated atoms, under laws concreated and concreted, were drawn together around innumerable foci, and the process of world making was thus commenced.

It is not claimed for the theory that it is established; but it is claimed that it so answers all the demands of the problem of world making, and is so without objections, and finds so much support from many well-known facts not otherwise

explicable, that it deserves to take rank as highly probable; and is accepted by many eminent specialists as almost demonstrably true; or, if not that, at least a rational deduction from the most accredited facts of science. Many theories take rank as scientific without a tithe of the evidence in their support. No other theory on the subject ever broached competes with it in rationality; indeed, it is impossible to allege any real ground of objection against it. The only ground for hesitancy named is that it seems to collide with certain statements of the Bible, and appears to make too little account of a personal Creator. But both of these allegations are pure fictions, as we shall see. If the nebular theory rested on or implied the eternity of the atom and its inhering forces, which some of its expounders have assumed, it would be open to these fatal objections. But that is precisely what it does not do, and what if it did do would be fatal, not simply as adverse to the Bible and as strictly atheistic, but on the more radical ground that it would thereby be reduced to absurdity and absolute impossibility. The theory attempts to account for the universe not as unmade, but as a product, and points out the method of its making, or the process by which it has been brought to its present condition. It is not guilty of the folly of alleging either that it is self-made or unmade; but by scientific method shows that it was made and in what manner the Maker proceeded. Its entire insistence is that it is a growth from a beginning, and it begins with the first stage and traces each stage of the movement to the present; every step requiring and demonstrating the presence and volitional agency of a personal builder as really and more impressively than if it were made in an instant and by direct efficiency. It starts with the assumption that the substances wrought into world structures were first originated in atomic severance. This is its corner stone, its absolute postulate.

Beginning thus with the atom, it affirms that it was not a simple extended something, but that it was a something endowed with a force by which it attracted, and was attracted by, every other substance or atom, or pervaded by a force working to the end now reached. The theory does not suppose the force in the atom to be of the atom, but a mode of the energy by which the atom itself exists.

These substances so originated and so endowed or pervaded were infinitesimally minute, and without collocation, and were diffused over illimitable space, the very space in which they were to be wrought into a history, ultimately culminating in worlds. Nebular hypothesis.

Portions of the space so filled were assigned (by the power which created and endowed these infinitesimal points) to a certain number or part of them as the theater of their action for world construction. The worlds to be built within the allotted space were to be built out of the atoms therein placed. The conditions were thus laid for the process to begin.

We take now for illustration, of the process which it assumes immediately began unfolding over the whole realm of space which had been filled with atoms, our own solar system, assuming that what took place here also took place wherever worlds were made. We have seen that the area assigned our system—that is, the solar system—was one definitely fixed, which we have occupied with absolute exactness always—that portion of space which divides midway between us and our nearest stellar neighbors ; that each star and any members that may belong to its system have a similarly fixed area.

We know as a fact that the sun and its planets, and all other suns and their planets, are composed of exactly the same substances in number and kind.

We know that within the definite area all the included atoms are held by and tend to a local center by an immutable law, to wit, as the mass and inversely as the square of the distance; and that under the sway of this law the atoms would become massed, increasing in density toward the center as they were drawn inward.

We know that, attendant upon the operation of this law, there is discoverable another universal motion of the atoms within the solar area, a rotary motion, which is still discoverable in the central body and all the planets around it.

We know that this motion of the mass is parent of another tendency in the mass, that of tangential motion—centrifugal force or tendency, offspring of rotation. We have thus centripetal force, or force of gravitation, and centrifugal force, offspring of rotary motion. We know that as a resultant of these two forces the planets are held aloof from the sun at a fixed distance, and are carried around it in a fixed orbit, and thus the system is preserved in perfect harmony of relation.

We know, further, that the motion of the atoms under the laws of affinity and gravitation brings them into closer contact or constantly growing compactness or density, and that when thus brought together they discover affinities, chemical attractions and repellences which interact upon them and produce intensity of motion among them, uniting them into collocations and compounds.

We know that such interaction and motion create heat, and intensified heat produces igneous fusion, or a molten condition of the mass, and evolves electricity and luminosity. These are well-known facts, and as we shall see, they go far to explain the phenomena of world building, and show how the result of the solar system as now found was brought about.

Keep in mind that we are seeking the time measures discoverable in the past history of the universe. This is the only thing at present aimed at. The question of method is introduced only, for the present, as it bears on this point.

We have already pointed out the evidence which demonstrates that the universe has existed in substantially its present condition as an inorganic system for millions of years. We wish now to sink the plummet into a still deeper depth, and study it in the time measures of its development to its present condition.

We need not say that this is not the only aim we have in view. Our real object is to reach a rational explanation of the process of world making, and by this means to interpret the grandeur of the universe and the greater grandeur of its builder. If we can put ourselves in possession of the facts that are and have been, we shall find out more of God and his greatness than in any other way. It is not honoring him to limit him in space or time, except as he limits himself, or to appoint to him a method which was not the method he chose. It is a great truth to ascribe the universe to him; but it imparts meaning to the ascription if we can have some adequate idea of the greatness of the thing which we ascribe to him; and if we can see how, through immeasurable ages, he has been carrying forward his work; and if, yet further, by both method and extent we can discover the goal to which all his movement tends. This is our ultimate aim in this discussion.

We return, then, to the point of departure in the process of universe building.

First, the material. This we have said was the creation of the atoms. That we know is true. We have further said that these were probably diffused through the whole area of space in which worlds were to be built out of them.

The space allotted to our solar system was that in which it is, and in which it is held in absolute fixedness, and has been so held from the first.

Space of the solar system.

This space we have defined to be that sphere which would be described by a boundary midway between our sun and his nearest neighbors on all sides. It is found to include an area about 20,000,000,000,000 miles in all directions from the central point, or that which our sun now occupies and has always occupied. The area, as you perceive, is a sphere about 40,000,000,000,000 miles in diameter. Within that sphere our sun, which is only a name for the center, had power of attraction over all included atoms such as to hold them from being drawn away, and such as to draw them away from the point which they occupied inward toward the center of the mass.

This process of motion toward the center immediately commenced with the existence of the atoms, under the operation of a fixed law. In unknown time, but of necessity a very long period, measured by millions of years, the mass had shrunk from its outer rim till it filled what is now the orbit of Neptune. Under the operation of the various forces known to have existed and acted on it from the first, though yet not condensed to a solid mass, it had become relatively compact and dense—the whole mass reduced from 40,000,000,000,000 miles in diameter to not more than a six thousandth of that bulk, and with a corresponding increase of intensity of interaction among its particles. The result was a globe of compact molten matter 6,000,000,000 of miles in diameter.

Centrifugal force, intensified by greatly accelerated motion, acting upon the now denser mass, threatened its allegiance to the centripetal force which still bound it together, and ultimately triumphed over it, and an outer ring rushed off at a tangent, but could not escape, nor yet be restored, and so by

a resultant force moved in an orbit of its own around the central mass, and, forming a secondary center of gravity in itself, became a globe and revolved on its own axis. The incipient Neptune took its place a newborn planet, the first of the solar group. The same forces worked in the new as in the old, and it commenced its growth toward complete planetary conditions.

The same forces also still continued their play in the old mass. Still shrinking toward its center, there came a time, ages how long there is no means of knowing, but necessarily immense, when it was reduced to the size of the orbit of Uranus, when again centrifugal force overbalanced centripetal energy, and another recusant mass was thrown off and, passing through the same process, was developed into a planet, with its fixed orbit around the original mass.

Thus through indefinite, or to us undeterminable, time, but doubtless appointed by infinite wisdom, one after another each of the planets was parted from the original mass and took its place in the solar system—after Uranus, Saturn, then Jupiter, then a planet which was broken into hundreds of fragments, but which are still found in an orbit; then Mars, then our earth home, then Venus, then Mercury, then Vulcan, youngest born; reducing the central mass—all that remained of it as we find it to-day, many thousands of times larger than all its planetary offspring, still held in absolute subjection to it.

If the nebular theory be true for the solar system it is true for all the universe, and we are required to push our time for origins back to a point when the entire universe existed in a state of thin, attenuated substance filling the entire space which it now occupies, each atom of which existed apart by itself, by an immediate creative act; or, if not that, a time when force was first imparted to it.

Nebular theory true for all sidereal systems.

There was a beginning to the changes which have taken place in the relation of the atoms; for any change necessitates a beginning. The universe began to be in the primary movement of the atoms toward their present condition, or by the creation of the atoms. The movement was necessarily simultaneous throughout all space and all atoms. So all worlds, as to their beginnings, are of the same age, and all movements identical throughout—the universe is a unit. The process was regulated and uniform. One stage followed another in exact order. The harmony throughout and the interdependence of all the parts determine this, and are impossible to be explained in terms of law without it. As all parts of an organism are carried forward together, so all the parts of the vast system of systems progressed *pari passu*. Nothing was left to accident. There are no accidental atoms in accidental spaces, and no accidental forces appearing at accidental times, or working in accidental ways and measures.

Of these preliminary stages of world building we have no means of determining the time measures, but we know what the processes were, and that they could not be without the consumption of almost infinite time. It answers no purpose to say that the Infinite could have brought it about in a moment. This is not doubted, had he so chosen, but the proof is that he chose to bring it about by a process, and that choice required time to work it out, and time of immeasurable length—not counted by millions of years, as time is now measured into years, but by eons which transcend human computation. And why not, since the worker has eternity to carry it to completion? Why suppose haste when we are able to detect deliberation? A single revolution of the solar constituents would have required a thousand years, its periphery moving at a velocity greater than the present rotary motion of the sun. The shrinking of the mass toward the center, and all chemical combinations,

require time. Think of the ages before the birth of Neptune, the ages more before the second entry was made in the family record, and so down to the entry of the earth's name and date —millenniads count nothing.

But if all this should be counted a dream, we come now to a time when we reckon with certainty. Whether or not the nebular theory is true, we know that our earth was at one time a fused mass. The evidence of this is conclusive. If we begin at this point to reckon its age we shall find it ancient enough. Sir William Thomson calculates that the time which elapsed from the first formation of a solid crust to the modern period may have been from 70,000,000 to 100,000,000 years, and the whole time from the vaporous condition of the solar system to the present must have been of course immeasurably greater.*

First, we must provide for its refrigeration and its consolidation into a solid crust. Who can give us the length of time required? We are in the reign of law. We have seen the evidence of its fused condition and of the intense heat which lingered for ages in the baked condition and metamorphism which characterizes immense thicknesses of overlying deposits. We know that immense time must have been required, and that some such phenomena as the following must have occurred. Chemical forces must have been intense. The gases must have formed the atmosphere by immense energy of union. Oxygen and hydrogen must have loaded the atmosphere with vapor as they struggled to form future oceans. The vast volumes of water to be in future time were then in elements seeking to constitute it. The oceans were then in vaporous embryo. How long they hung in clouds before they could condense and fall upon the burning mass, to be returned to burning vapor, who can conceive? That it was immeasurable time we are forced to believe.

* Dawson's *Earth and Man*, p. 14.

The earth was a vaporous globe, the oceans hung in the clouds.

Then there came a time when the crust was tempered sufficiently to tolerate a boiling envelope, wrapping it over without a shore, and "darkness was upon the face of the deep."

The conditions of stratified deposits had come. From this period, the dawn of the second earth age, data become more certain and time measures relatively determinable; and we are able to perceive both the exact processes and the comparatively reliable chronology of world growth. The new rocks tell the story.

Ancient earth surface.

It is impossible to determine whether any portion of the ancient earth crust, after cooling so as to receive and retain its watery envelope without returning it to vapor, appeared as dry land, or sedimental continent, or was all submerged for a time, until portions were uplifted into high table-lands. The amount of water in the globe is a fixed portion of it. It is sufficient to cover all its surface since it formed its solid crust, on the supposition that its surface was of uniform elevation, about or nearly two miles in depth, or nine thousand feet. The extreme height of land above the sea level is five miles; the extreme depth of the ocean is about the same. The mean heights of continents are given by Humboldt as follows: Europe, 671 feet; North America, 748 feet; South America, 1,151 feet; Asia, 1,132 feet. The mean height of all land is not far from 1,000 feet. The mean depth of the ocean is put from 12,000 to 15,000 feet.

The general surface of the earth, beginning with its earliest solidified crust, or immediately subsequent, is uneven and irregular; some portions depressed, others elevated. The depressed parts are beds of oceans; the protuberant, higher table-

lands, existing as continents or smaller islands. The elevated portions have frequently been depressed, and some of the submerged portions have frequently been elevated. The oceans of one era have been the dry lands of another, and *vice versâ*.

The age of stratified rock commenced early after the solid crust was formed.

Stratified in water.

All stratified rocks were made in water by sedimentation or the precipitation of earthy matter held in solution or deported in currents, and, as a rule, soon acquire a consolidated form. The process of consolidation is always progressing before our eyes, and has been through all the ages.

The evidence is perfect that all stratified rocks were once mere earthy deposits gradually made, but with somewhat varying ratios of amount in a given time. Earth deposits, in fact, in geological terminology, are rocks.

Stratified rocks are laid horizontally, in obedience to the law of gravity, but conformably in a degree to the surface on which the sediment is precipitated. When tilted or highly inclined there is evidence of disturbance subsequent to the original placement, or of previous irregularity of the subocean surfaces on which they were placed.

The original position of strata indicates their respective age. Superposition, if not by displacement, is always more recent. If, therefore, the original position of any series of strata be retained, or be not misplaced by some subsequent disturbance, the relative age of the strata which compose the series may be determined with absolute certainty. Relative age is also determinable by other signs, as constitution of the strata as to material and fossil contents.

Metamorphic strata.

Metamorphism of strata as a rule indicates the most primitive members of the family, but not always. Local agencies have produced metamorphism in recent strata.

Disturbance of strata is common; but few sections present any extensive series in their original horizontal position. They are usually contorted, broken up, and variously dislocated, and great care is required in unraveling their exact history.

Order of strata.

It is estimated that the series of strata, commencing with the most primitive and reaching to the present, could they be placed in the exact order of their original formation, would show an aggregate of not less than ten miles in thickness; that is, there has been laid down upon the floor of the unstratified crust, if they could be gathered in their time order, a sedimentation of that extent.

There are several lines by which to estimate the extent of stratification over the earth's surface.

Denudation.

The elevated portions of continents and high mountain districts show how much denudation has taken place in several ways. The horizontal strata of isolated mountain peaks correspond to each other as they appear in different peaks, pointing to the fact that at a time the intervening valley was cut away and removed by erosion. The process now going forward in depressing the gorge requires only to be pushed back to a time when it commenced on a surface equal or greater to the elevations still remaining to show what amount of erosion has taken place, and also how long it has required. This calculation makes no account of the fact that probably, almost certainly, the peaks themselves have been lowered by erosive agency, which would of course show the actual erosion to have been much greater than the apparent, and would also show a corresponding increase of time.

Where strata have been bent upward by heat agency, and the ridge has been cut away by denudation, the strata on the two sides of the mountain are found to agree, and by measuring across their outcrop, that is, the ends which are upturned and disclosed by denudation, we are able to see that the cap over which they once lay has been removed to a height or depth equal to their thickness, or greater. The present elevation in such a case has been reduced from as much higher a level as the restored cap would carry it. The effect is to show as much deportation of matter as if it were a corresponding gorge cut in a horizontal plain.

Strata lifted and upturned.

By these and other facts it is shown that the amount of erosion over wide regions is enormous beyond power of computation.

To this must be added another method of proving the result. The *débris* of erosion is carried down into seas, lakes, and oceans, and then laid down in strata, and the amount of stratified rock thus made becomes a proximate measure of the matter removed, minus the amount that failed to reach the point where the accumulation took place. The erosion could not be less than the stratified rock, but might be more. If the matter so removed were spread over an equal area to that from which it was deported it would show the exact amount of erosion, or if it could be returned it would show what the original elevation was over the entire area.

Sea deposits.

Now, it is a fact that the stratified rocks over vast districts, even continents, are from 10,000 to 50,000 feet thick. "It is certain, therefore," Le Conte says, that "the average thickness of strata over the whole known surface of the earth is not less than several thousand feet." Replace the entire amount of all sedimented rock to its original situation, and it would show what the whole amount of erosion has been.

Depth of strata.

The two answer exactly to each other. Taking the average thickness of 2,000 feet, he says: "We therefore return to our estimate of 30,000,000 years, with the greatest confidence that it is far within the limits of probability."

This seems to be an enormous statement, but before we so pronounce it let us remember that it falls far within the limits fixed by other eminent authorities, and let us be at the pains to consider the several grounds for the conclusion. That the time is immense we know.

Order well established.

The order of the series is well established by an amount of painstaking labor absolutely amazing. No one can make himself acquainted with the facts without being impressed with the honesty and thoroughness of the work. Scarcely a portion of the earth's surface has been unexplored. The soils and rocks and flora and fauna of all the ages have been interrogated and rifled of their long-withheld secrets.

The result has been tabulated and summed up with the utmost scientific precision. The whole series has been subdivided into eras, and the reason for the division assigned, in some change, which marked a new and distinct departure—the opening and bounds of a new age well defined.

If we begin at the beginning, the most primitive era lying on the original floor of the earth's crust, which is the natural and proper order, we have as the result:

Primitive era Paleozoic.

First, The Archæan age. The group is called Laurentian and Huronian. Second, Overlying it, the Paleozoic age, comprising the Cambrian, Lower Silurian, Upper Silurian, Devonian, and Carboniferous groups, distinguished by specific characteristics by which each member of the group is known, and together constituting an era of geological history. Third, The Mesozoic era, comprising the

Triassic, Jurassic, and Cretaceous groups. Fourth, The Cenozoic era, comprising the group formerly better known as the Tertiary series: Eocene, Miocene, and Pliocene group. Fifth, The Quaternary era. This reaches to our own age. Now we will return and consider the eras separately and note their bearing on the chronology of the earth's growth.

As an example of the effect of erosion and the manner of its occurrence, and to show the carefulness of the methods adopted in reaching the conclusions which have been arrived at by students of the science, we give one or two illustrations.

"An hydrostatical basin of a river, lake, or gulf is the whole area of land, the rainfall of which drains into the river, lake, or gulf. Thus the hydrographical basin of the Mississippi River is the whole area drained by that river. It is bounded on the east and west by the Allegheny and Rocky Mountains, and on the north by the low ridge running from Lake Superior westward. The whole area of continents, with the exception of rainless deserts, may be regarded as made up of hydrographical basins. The ridge which separates hydrographical basins is called a watershed. It is evident that every portion of the land, with the exception of the rainless tract already mentioned, is subject to the erosion of water and is being worn away and carried into the sea. There have been various attempts to estimate the *rate of this general erosion.*

Hydrostatical basin.

"This is usually estimated as follows: some great river, such as the Mississippi, is taken as the subject of experiment. By accurate measurement during every portion of the year the average amount of water discharged into the sea per second, per hour, per day, for the year is determined. . . . This amount, divided by the area of the river basin, will give the average *thickness of the layer of insoluble matter removed from the basin in one year.* To this must be added the amount of the soluble matter, which is about one sixth the amount of the insoluble.

"Estimates of this kind have been made from two great rivers, namely, the Ganges and the Mississippi. The whole amount of sediment annually carried to the sea by the Ganges has been estimated at 6,368,000,000 cubic feet.

"This amount spread over the whole basin of the Ganges (400,000 square miles) would make a layer $\frac{1}{1751}$ of a foot thick. The Ganges therefore erodes its basin one foot in 1,751 years. The area of the Mississippi basin is 1,244,000 square miles. The annual discharge of sediment, according to the recent and accurate experiments of Humphrey and Abbott, is 7,471,411,200 cubic feet, a mass sufficient to cover an area of one square mile 268 feet deep. This, spread over the whole basin, would cover it $\frac{1}{4640}$ of a foot. Therefore this river removes from its basin a thickness of one foot in 4,640 years. The cause of the great difference in favor of the Ganges is that this river is situated in a country subject to a very great annual fall of water, the whole of which falls during a rainy season of six months. The rains are therefore very heavy, and the flood and consequent erosion very great. The erosive power of this river is still further increased by the greater slope of the basin, as it takes its rise in Himalaya, the highest mountain in the world.

Ganges basin.

"Now, since continents may be regarded as made up of hydrographical basins, the average rate of their erosion may be determined either by making similar experiments on all the rivers of the world, or, since this is impracticable, by taking some river as an average. We believe the Mississippi is much nearer an average than the Ganges. It can hardly be less than the average, for a considerable portion of the earth—as rainless deserts—is not subject to erosion. It is probable, therefore, that the whole surface of continents is eroded at a rate not exceeding one foot in 4,640 years. For convenience we will call it one foot in 5,000 years. We will use this estimate when

we come to speak of the actual erosion which has occurred in geological times." *

We take another illustration of the same point from the same author to show another phase of the calculation. The case selected is that of the Niagara Falls. Of this he says: "The plateau on which stands Lake Erie is elevated about 300 feet above that of Lake Ontario and is terminated abruptly by an escarpment about 300 feet high. From this point a narrow gorge with nearly perpendicular sides, and 200 to 300 feet high runs backward through the higher or Erie plateau as far as the falls. The Niagara River runs out of Lake Erie and upon the Erie plateau as far as the falls, then pitches 167 feet perpendicularly, and then runs into the gorge for seven miles to Queenstown, where it emerges on the Ontario plateau. Long observation has proved that the position of the falls is not stationary, but slowly recedes at a rate which has been variously estimated from one to three feet per annum. The process of recession has been carefully observed, and the reason why it maintains its perpendicularity is very clear. The surface rock of the Erie plateau is a firm limestone. Beneath this is a soft strata. This softer rock is rapidly eroded by the force of the falling water and leaves the harder limestone projecting as *table rock*. From time to time these projecting tables are loosened and fall into the chasm below.

Niagara Falls.

"Now, there is every reason to believe that the fall was originally situated at Queenstown, the river falling over the escarpment at that place, and that it has worked its way backward seven miles to its present position by the process we have just described. These reasons are as follows: 1. The general configuration of the country as already described suggests such an explanation to the most casual observer. 2. A closer examination confirms it by showing that the gorge is truly a *valley of*

* Le Conte, p. 11.

erosion, since the strata on the two sides correspond accurately. 3. As already seen the falls have receded in historic times at a rate, according to Mr. Lyell, of about one foot a year. The portion of the gorge thus formed under our eyes does not differ in any essential respects from other portions further down the stream." *

"All attempts to estimate accurately the time consumed in excavating Niagara gorge must be unreliable, since we do not know yet the circumstances which controlled the rate of recession at different stages of its progress. Among these circumstances are the volume of water, and especially the hardness of the rock, and the manner in which hard and soft are superposed. The present position of the fall, is apparently favorable for a rapid recession. Mr. Lyell, thinks from personal observation that the average rate could not have been more than one foot per year, and probably less. At this rate it would require about 36,000 years, but, whether more or less than this amount, this period must not be confounded with the age of the earth. The work of excavating the Niagara chasm belongs to the present epoch, and the time is absolutely insignificant in comparison with the inconceivable ages of which we shall speak in subsequent parts of this work." †

It should be said in this connection that the Niagara River commenced its flow since the tertiary deposits, as it cut through them in wearing its channel.

Age of rivers.

The age of rivers, and therefore the time during which they make their contribution to strata, is an important matter in ascertaining the time during which given strata have been created. The age of a river is determined by the strata existing at the time when it begins to flow and by the character of the deposit it makes, and that is determined by finding first the strata eroded by it, and the characteristic sedi-

* Le Conte, pp. 12, 13. † *Ibid.*, pp. 14, 15.

ments it carries to or contains in its currents and deposits in its deported matter. When its banks show that it has cut through strata, as in the case of Niagara, it is proof positive that the strata were already placed when it commenced its erosions. In the case referred to the proof is that the Niagara was started in its work of erosion during or at the end of the tertiary deposits or of much later date. In the case of the Mississippi the proof is positive that its erosions commenced—that is, that the river was born, not earlier than the modern era, and all its effects of denudation and sedimentation must be since that period. *Ab uno disce omnes.*

The same set of facts determine the age of mountains and all continental upheavals. When a series of strata are found to be superfixed upon high plateaus, or to be twisted and disturbed along the sides and to the denuded summits of mountains, the proof is that the uplift was after the disturbed strata had been placed. They could not otherwise be found crowning the plateau or summit, or be distorted by the upheaval. The time of volcanic mountains is determined by the same obvious principles.

Age of mountains.

With these perfectly obvious principles in view we are now prepared to study the story of the earth as recorded in its stratified rocks, rivers, and mountain ranges.

The general principle on which the science works is this: that the unstratified floor of the earth crust was first in the time order of its existence, whether recent or ancient; and also superimposed deposits have been subsequent in the order of their superposition, and that, could we obtain the unbroken series at any point, that series would tell the proximate age and order of the world's growth. But since that cannot be done, for the reason that no known portion has been under the sea continuously from the first, we can only

Time order of deposits.

arrive at the fact proximately by taking the respective members of the series where we find them and are able to determine their position now by underlying, and now by overlying members, and thus create the series; and by finding the extent of the individual members and the probable time required for their making, adding the series together, find the extent of the whole and the probable time of the whole.

Adopting this method, we may fall below, but cannot rise above, the entire thickness and entire age of the process.

There is a valuable article in the *Independent*, February 2, 1893, by Professor G. Frederick Wright, on "Geological Time Ratios and the Antiquity of Man." He shows, by numerous citations from various eminent authorities, a tendency to abbreviate the time measures assumed by the earlier geologists; but he also shows that it is impossible from all the data to reduce the time of the appearance of life on the earth to a period more recent than 20,000,000 years, while the advent of man may possibly not exceed 10,000 years. It appears that in the last thirty years more than a score of earlier geologists have in various ways made calculations from ascertained data carefully considered. Naturally they differ, but all substantially agree as to the vast extent of time absolutely demanded. Five hundred million years was the least amount of time Lyell would admit to have elapsed since the beginning of life upon the world. He may be said to be the father of scientific geology. Darwin, in his first edition of *The Origin of Species*, thought 306,662,400 years (which was the period assigned by him, reasoning from the extent of their erosions to the age of the Wealden rocks) was a "mere trifle in comparison with the time required in many other instances of erosion."

The calculations of Sir W. Thomson, approaching the subject from another point of view, that is, from a consideration of

the earth's physical condition and the rate at which it is losing heat, led to the result that the earth was in no condition for the beginning of life earlier than 100,000,000 years ago, and that probably the limit of life's beginning must be set considerably nearer the present time. George H. Darwin thinks he has practically demonstrated that only 57,000,000 years ago, and certainly not over 100,000,000 years ago, the birth of the moon took place, amid conditions that were utterly incompatible with the existence of organic life upon the world. Professor Newcomb, the astronomer, from another standpoint, comes back from his prolonged study of the sun's heat with the confident assertion that, at the present rate of radiation, the supply of heat could not endure more than 18,000,000 years, and that previous to 10,000,000 years ago the sun's heat must have been so great that water could not have existed on the earth in a fluid state. Professor Tait also comes by independent calculation to almost the same conclusion. Professors Young and Croll admit the difficulty, but would gain more needed time for the geological facts from possible modes of increasing the diminishing heat of the sun, possibly giving 100,000,000 years of time for the reign of life. The latest calculation drawn from physical considerations is that of Mr. Clarence King, in an article in the *American Journal of Science*, who thinks it well-nigh demonstrated that 24,000,000 years is all the time that can be granted to the geological history of life.

The astronomers seem to require less time than the geologists, but it is only a difference, and both demand enormous periods. Mr. Wallace made a calculation a few years ago on the time requisite for the deposition of the sedimentary rocks on Professor Houghton's estimate that their total thickness was 177,000 feet. He attempts to get the rate of accumulation by estimating the amount of denudation which takes place at the present time, and the area over which it is being

deposited on the present sea bottom. By combining all the data concerning erosion it appears that the present land surfaces of the world are being worn away and carried into the sea to the extent of one foot of their superficial area in 3,000 years. The main agents of these erosions are the countless rivulets, each contributing its mite toward carrying the loosened material of the highlands into the valleys and thence into the rivers, which are continually disgorging their contents into the waters of the ocean. This is a fair estimate. The total length of coast line of the world is 100,000 miles, and Wallace estimates that the dirt carried into the sea by the rivers and washed from the shores by the waves is all of it deposited on the bottom within thirty miles of the shore, or upon an area of about 3,000,000 square miles, a quantity about one nineteenth as large as the total area of the land surfaces of the world. According to this, therefore, one foot of sedimentary deposit represents the work of one hundred and fifty-eight years. Taking this as a multiplier, and Professor Houghton's 177,000 feet as the multiplicand, we obtain 28,000,000 years as all the time required for the accumulation of the sedimentary rocks. This is the lowest estimate having any probability, or even possibility, of a proximate truth in it.

In apportioning out this time to the different geological periods all agree that the earlier demand a much larger period than the later. According to the estimate of Dana and Winchell the ratios are of twelve for the paleozoic, three for the mesozoic, and one for the cenozoic. That is, the time since the beginning of the tertiary would be one sixteenth of the whole, which, upon Wallace's basis of results, would allow less than two millions for the tertiary and post-tertiary periods.

All the authorities agree that the age of life on the planet cannot be less than twenty millions of years, and almost unani-

mously, deducing their conclusions from varied astronomic and geologic data, and from all lines of approach, fix the period as more probably more than double that time.

The subject of geological time continues to interest a wide class of investigators. The most recent attempt at the solution of the problem was made by Mr. Charles D. Walcott, of the United States Geological Survey, in his vice presidential address before Section E of the American Association for the Advancement of Science. Mr. Walcott's estimates are wholly made from geological data, so that whatever truth or error there is in his calculations rests upon a basis entirely independent of that of the calculations of astronomers and physicists, of which we have had so many in recent years. On this account the substantial agreement with the moderate figures of Sir William Thomson, George Darwin, Professor Young, and Clarence King is the more significant.

Mr. Walcott bases his estimates upon the sedimentation of the Cordilleran area in the United States, which lies between the Rocky Mountains and the Sierra Nevada.

The paleozoic rocks of this area are composed both of mechanical and chemical sediments. The mechanical sediments (that is, sandstone and shales) of this area are estimated to have an average thickness of 10,000 feet for the lower division and 5,000 for the upper. The area of the sea in which this deposition occurred was about 400,000 square miles. The area of land draining into the sea was, however, nearly three times greater in the earlier period than in the later. The character of the sediment indicates a rapid rate of erosion and deposition. Mr. Walcott estimates the probable rate of erosion from the land surface to have been one foot in 200 years, and the rate of deposition to have been, for the earlier period, one foot in 50 years, and for the later period one foot in 132 years, which, with some minor allowances which are to be made, gives

1,200,000 years as the time requisite for the deposition of the mechanical sediments occurring in this area.

But the chemical deposits (chiefly limestones) in the Cordilleran sea of this same period are the most important. These Mr. Walcott estimates to have been contributed at the rate of 128,000,000 tons per year, and that the total amount of calcium is 2,000,000,000 tons, which at the rate given would require 16,300,000 years. Add to this the 1,200,000 years estimated for the deposition of the mechanical sediments, and "we have a total of 17,500,000 years as the duration of paleozoic time." Dana's time ratios are 12 for paleozoic, 3 for mesozoic, and 1 for cenozoic. Walcott would "increase the comparative length of the mesozoic and cenozoic periods, so that the time ratios would be: paleozoic, 12; mesozoic, 5; cenozoic, including pleistocene, 2." According to him, therefore, the total length of geological time from the beginning of the paleozoic, that is, from the beginning of life, would be for paleozoic 17,500,000 years, mesozoic, 7,240,000, and cenozoic (since the beginning of the tertiary) 2,900,000 years, giving to the entire series of fossiliferous sedimentary rocks 27,650,000 years. Adding to this a liberal estimate for Algonkian (17,500,000) and archæan (10,000,000) rocks, he concludes that every attempt at calculation which he has made "that was based on any reliable facts of thickness, extent, and character of strata," reached "a result that does not pass below 25,000,000 to 30,000,000 years as a minimum, and 60,000,000 to 70,000,000 years as a maximum for post-archæan geologic time. . . . Geologic time is of great, but not of indefinite, duration. . . . It can be measured by tens of millions, but not by single millions or hundreds of millions, of years."

For purposes of comparison we give the following estimates by recent authorities: Sir William Thomson, within 100,000,000 years; George H. Darwin, probably 57,000,000 years;

Professor Tait, apparently 10,000,000 years; Professor Newcomb, 10,000,000 years; Clarence King, only about 24,000,000 years; Sir Archibald Geikie, a minimum of 73,000,000 years; J. D. Dana, oldest fossiliferous rocks, 48,000,000 years; Alfred Russel Wallace, only about 28,000,000 years; T. Mallard Reade, 95,000,000 years; Mr. Warren Upham, about 100,000,000 years.

Students of earth history, its growth and development as recorded in the Silurian strata, have, as previously noted, divided the whole history into five epochs or eras.

"These grand divisions, with the exception of the last, are founded on an almost universal unconformity of the rock system and a very great and apparently sudden change of the life system, a change affecting not only species, but also genera, families, and even orders.

"Unconformity is the result of deposit of new strata on old eroded land surfaces, and therefore always indicates an oscillation of the crust at the time, and an immergence and submergence of land. In every such case a portion of the record is lost which may or may not be recovered elsewhere."

Ages are sometimes substituted for eras, of which there are seven noted. These are distinguished by the prevalence of organisms: 1. The Archæan or Eozoic age, in which eozoon, a most rudimental form of life, is supposed to appear. It was parallel with the Laurentian, the most ancient system of rocks. 2. The molluscan age, or age of invertebrates. It was parallel with the Silurian series. 3. The age of fishes, which rises with the Devonian system. 4. The age of acrogens, sometimes called the age of amphibians, and dawning first in Carboniferа and extending throughout the system. 5. The age of reptiles, appearing in the Permian or secondary rocks and reaching up through the mesozoic series. 2, 3, 4, 5 make the paleo-

zoic era. 6. The age of mammals, dawning and extending through the tertiary up into the quaternary. 7. The age of man, characterized as modern or most recent.

Each of these ages, while characterized by definite and specific types of life, has something in common with those of other series. The same species carry up to a greater or less extent, but new orders immerged which in their variety denote a new age.

Thus it is seen that from the dawn of organic existence there has been an ascending series. Of this, whatever its significance, there can be no question. There is a noticeable advance, not merely changes, in the types and orders of life, but never a total abolishment of life. There have been periods when there was a wide destruction of organisms, but there is no absolute gap.

It cannot be questioned that there have been great climatic changes and other variations in the general conditions of the earth running through these vast epochs, for it will appear that each of these ages represents immense measures of time. We shall have more to say on the subject further on.

We return to note these eras and ages more particularly, to find what they give us as to the time measures and growth of the world separately. We begin with the Laurentian series. For a long time and after much research this series was supposed to be absolutely azoic. It is even now doubted whether throughout almost the entire era there was any organic existence. Of course, during vast measures of time after sedimentation was commenced, it was impossible that any form of life should exist. The evidence of igneous intensity, if not absolute fusion, is proof. The under crust was too thin and heated and much exposed to violent disruption to furnish the conditions for even initiating life in any form. If that condition had

passed during any part of this system, it has left very imperfect records.

Almost the entire series appears in the subarctic regions, but extending far southward toward equatorial regions. It underlies the paleozoic strata, and with good reason is supposed to be the most primitive formation. It is of immense thickness and always highly metamorphic, and destitute of the semblance of fossils almost universally. It is more contorted than any other series, and shows violent disruptions and dikes and veins in a conspicuous degree, and is signally unconformable to Siluria, which immediately overlies it. It is found extending over all the regions north of Canada, runs to Labrador, and up to the farthest north accessible, probably to the Arctic Ocean, and through portions of the United States bordering on the provinces from the west to the east, reaching far into New York, and westward extending over all the States and Territories of Nebraska, Montana, Idaho, Wyoming, Colorado, Utah, Nevada, down into New Mexico, Texas, and Arizona. It appears also in the northern parts of Central Europe, conspicuously in Scotland. It is schistic in constitution, marked by the predominance in one section of gneiss and granite, and in another of gneiss, hornblende, syenite, and sandstones, passing into quartzites and marbles. It is interlarded with immense beds of iron ore and great quantities of graphite.

Laurentian era.

The Laurentian era has been studied with great care by Layard, and especially Dawson. They agree that it cannot be less than 40,000 feet—about eight miles—in thickness. It is doubtful if any older land surface is known on the globe. Proof that it was laid in boiling oceans on heated crust is clear, and the crust from which it derived its material and more ancient land surface is either hidden away or has not been discovered.

Le Conte agrees with the eminent authorities above cited that the series is not less than 40,000 feet in thickness. The peculiarly contorted condition of the formation, arising from its nearness to igneous agency and the shrinkage of the inner molten mass during the immense time of its making, furnishes the means for discovering its thickness. Upheavals, breaks, denudations of the summits through ages, lay the strata bare to observation and measurement.

Time for the deposit.

The time required for the deposit is variously estimated at from 3,000,000 to 6,000,000 of years. Le Conte thinks, and with reason, as shown by the thickness of the series, that the Laurentian era is longer than all the rest of the recorded history of the earth put together. But he calculates that the Carboniferous age alone requires between one and two millions of years. According to this calculation the Laurentian era must have consumed many millions. Le Conte estimates that the actual erosions measured over the entire earth required more than 30,000,000 years.

No one can examine the data without being impressed with the feeling that great caution has been observed in arriving at these seemingly extravagant conclusions. That enormous time passed during the positing of this archaic and azoic series is beyond the possibility of doubt, and there is no other rule to be observed than that of allowing sufficient time for the effect. There is no reason for limiting the time measure below what the facts seem to demand. And it should be taken into the account that only a part of the facts are in. If the known facts require such amazing time, the chances are all that other unknown facts would increase the demand. The actual deposits may be much greater than any known, since denudation may have carried away in such immense periods as much as has been left. In any event, there is abundant proof that immense time passed between the hardening of the crust over a molten globe

and the time when it was fitted to receive the paleozoic strata corded from lower base to upper stratum with memorials of life, and preceded as it was by azoic sedimentation from 30,000 to 50,000 feet thick.

Following the Laurentian and preceding the lower paleozoic era was a period of upheaval and great disturbance. The Laurentian deposits in the older ocean were lifted into the skeleton of a continent over the regions already described, and were again, in portions, submerged, and in greater portions remained land surfaces; so that the new paleozoic deposits were largely made by the erosion of the Laurentian strata, by their denudation and deportation into paleozoic basins. The superposition of this new series of deposits is proof positive of the fact, and disconformity marks, but gives no account of, the interval as to extent of time.

A new age began, and its chronological beginning and after history is written in the paleozoic series from the Cambrian preface to the Permian finis, with the intermediate pages of Siluria, Devonia, and Carbonifera. The pages are not complete, for there were many uplifts during its progress where blanks occur. But recessions by the overflowings of seas and oceans resumed the record, and it appears with wonderful fullness, if not completeness.

The different ages in the series are distinctly marked: first came the Cambrian primordial group, then the marvelous Silurian series, then the Devonian, then the Carboniferous, over all the Permian. The orders of life in the series mark their limits.

The entire series is next in thickness, and by consequence next in time measures, to the Laurentian, reaching not less than 40,000 feet. The Silurian and Devonian and Carboniferous are especially interesting geological fields.

For the present we have in view the single point of determining the probable time measures of the series. We therefore

make no note of the organic or fossiliferous contents which characterize them, with the exception of the Carboniferous group, and in this case only as it bears on the question of time.

Paleozoic.

The paleozoic system has distinct characterizations, and has claim to be a distinct rock system, revealing a new order and stage—a distinct *time*-world—being unconformed to the series below and also to the series above, or the under and overlying systems. Distinct, as if not the absolute dawn of the world of life, its first notable manifestation, and its manifestation in marvelous profusion and characteristic types. Twenty thousand species have been already catalogued and described. Le Conte says: "Of all this teeming life there is not a single species similar to any found in any other geological time. And not only are the species peculiar, but even the genus, the families and orders, are different from those now existing." A new age with it clearly begins and runs a long and continuous history.

As stated already, the entire series shows not less, probably much more, than 40,000 feet in thickness. The subdivisions are distinguished chiefly by types of life regnant at the period of their formation. North America, and particularly the United States, is the most noted for the entire series, but they appear in Europe, and indeed in all great divisions of the world, with greater or less fullness of representation.

The paleozoic era is divided into three ages, characterized by the dominance of great classes of life. They are (1) the Silurian system, known as the age of invertebrate animals—molluscans; (2) the Devonian system, or age of fishes—superimposed; (3) the Carboniferous system, or age of land vegetation and amphibians.

The systems are conformable as a rule, and show no other

disturbances than those of successive uplifts of ocean beds and submergences of land surfaces; no such oscillations as break up the reigning system and introduce a new era.

At the beginning of the Silurian age the land surface was Laurentian, from which deposits were made. The first or oldest deposits were in seas bordering on the Laurentian shores, which extended, perhaps, far south, followed by further subsidences as the age progressed, until the shore line reached to the bases of the Laurentian ranges in the far north, and the Silurian sea rolled over all the regions from the Rocky Mountains in the west, northern boundaries in Canada, and the Appalachian chain, reaching far south beyond Virginia into Georgia. In this great basin the age made its deposits, as is shown by the facts now open to examination. The Silurian age is marked by the two limits—so much of the sea bottoms as received the earliest deposits, and the uplifts of these deposits into land surfaces—so that the land became Laurentian and Silurian. The uplift was gradual from the north southward. The more recent or newer, called upper Silurian, deposits are found on the southern border. These facts are distinctly marked and well known by all practical geologists. As our only aim is at present to reach a proximate estimate of time, we are not concerned with the life system, except as it bears on that point.

Silurian.

That Siluria occupied a vast period during which its peculiar life flourished and its immense deposits were made is beyond dispute. No age has left more abundant memorials or is more distinctly marked. There is reason to believe that Silurian seas washed the bases of Laurentian shores many scores of thousands of years before the Devonian age was in its dawn.

The Devonian age, or age of fishes, followed the Silurian age, or age of mollusks. Siluria had been lifted and the shore

line pushed seaward. The deposit overlaps Siluria; and is distinguished from it chiefly by new types of life, both sea and land. We can only note the fact that land plants were now first introduced, except a few club mosses which appeared in the last days of the Silurian age. The abundance and kind of land plants which appeared were the harbingers of the next succeeding age—Carbonifera. Fish life also now for the first time appeared in a variety of forms. Thus both land and sea enter upon a new order or new orders of life. Vertebrates are added to the animal varieties.

Devonia occupies a briefer time than Siluria, but its characteristic formation must have required a period not limited to less than scores of thousands of years, measured by the known processes of sedimentation. The life of these ages might have been suddenly introduced at any time, but the rocks in which its history is recorded could not be produced by the known laws of sedimentation in a brief period. There was an age limited by Siluria in the front and Carbonifera in the end, and the rocks piled stratum upon stratum, denoted by the life of the time, mark a lengthened era, not as compared with greater divisions, but as compared with thousands of years in human annals. During the Devonian age the seas swarmed with fishes, and vegetation became prophetic of the age immediately following.

To anyone informed of the facts, and standing at this epoch at its close, and looking back over the line of earth growth from the cooling of its primitive crust through Laurentian deposits and Silurian formations and Devonian developments, the demand for immeasurable time becomes an inevitable conviction.

The age immediately following is, on many accounts, the most interesting in the whole scale of geological history, both

on account of its marvelous character and its peculiar interest to man. If not more wonderful in its life and the agencies which produce it, it more than any other indicates forethought and purpose in the ordering of the Infinite mind. The iron lodes of the Laurentian system and the carboniferous deposits of the paleozoic system point unmistakably to the demands of an age yet far in the future. But we will not anticipate or deflect from the sole purpose we now have in view, namely, to find the time measures of earth growth. Other matters will come in their proper places.

Carboniferous.

The carboniferous age is more perfectly understood in some respects than any other. Its practical relations to man have brought it more completely under his observation.

It lies on the top of more than seven, perhaps ten, miles of preceding deposits, thousands of feet of which contained the casts of vanished generations and orders of life long since abolished from the earth. It was laid down in the same seas in which other formations had been deposited, but as we shall see in successive periods of submergence. The age is divided into three periods: (1) Sub-carboniferous, (2) Coal measures, (3) Permian or overlying and transition rocks.

The first of these periods may be said to be preparatory or prophetic, the second the period of realization, the third the period of decline or *finis*.

The entire thickness of the deposit varies from 15,000 feet in some districts to not more than 5,000 in others. But a small part of this great thickness is proper coal deposit, perhaps not more than one part in fifty. The coal seams are interloded with superimposed strata of various rocks. There are only five or six workable veins, but scores of smaller deposits. A seam is not considered workable if less than three or four feet thick. Occasionally a vein is sixteen to twenty feet thick. Taken together, thin and thick seams, there are in Belgium 100, and

in Westphalia 117. The aggregate thickness of all seams in Lancashire is 150 feet; in Pottsville, Pa., 113 feet; in Western coal fields, 70 feet.

Time measures of the deposit.

On the estimate of time for these deposits Le Conte says: "We have said that it is important that the mind become familiarized with the idea of the immense time necessary to explain geological phenomena. We therefore embrace this opportunity to make a rough estimate of the coal period. The estimate may be made either by taking the whole amount of coal in a coal field as the thing to be measured, and the rate at which vigorous vegetation now makes organic matter as the measuring rod, or else by taking the whole amount of sediment in a coal basin as the thing to be measured, and the rate of accumulation of sediments in large rivers as the measuring rod. We will give both, though the latter is probably the more reliable.

"From aggregate amount of coal. A vigorous vegetation, as, for example, an average field crop or a thick forest, makes about 2,000 pounds of organic matter per annum per acre, or 200,000 pounds, or 100 tons, in a century. Recent researches considerably increase these numbers. But according to Bischoff vegetable matter in changing to coal loses on an average four fifths of its weight by the escape of CO_2, and CH_4, and H_2O, only one fifth remaining. Therefore, vigorous vegetation at present could only make about one eighth of an inch of coal specific gravity 1.4 per century. To make a layer one foot thick would require nearly 10,000 years. But the aggregate thickness in some coal basins is 100 feet and even 140 feet. This would require the former near 1,000,000, the latter 1,400,000 years. It is probable, however, that coal vegetation was more vigorous than the present vegetation. Our measuring rod may be too short; we will try the other method.

"From amount of sediment. We are indebted to Sir

Charles Lyell for the following estimate of the time necessary to account for the Nova Scotia coal measures. This coal field is selected because the evidences of nonsediment are very clear throughout. The area of the coal basin is given as 18,000 square miles; but the identity in character of portions now widely separated by seas—for example, on Prince Edward Island, Cape Breton, Magdalen Islands, etc.—plainly shows that these are parts of one original field that could not have been less than 36,000 square miles. The thickness of South Joggins is 13,000 feet. At Pictou, one hundred miles distant, it is nearly as great. We shall certainly not err on the side of excess, therefore, if we take the average thickness over the whole area as 7,500 feet. This would give the cubic contents of the original delta deposits as about 51,000 cubic miles. Now the Mississippi River, according to Humphrey and Abbott, carries to its delta annually sediments to cover a square mile 268 feet deep, or nearly exactly one twentieth of a square mile. Therefore, to accumulate the mass of sediment mentioned above would take the Mississippi about 1,000,000 years.

"It may be objected to this estimate that it is founded on a particular theory of the accumulation of the coal measures. The answer is plain. Any other mode would only extend the time, for this mode is more rapid than any other.

"We therefore return to the estimate with increased confidence that it is far within limits. But the coal period is not more than one thirtieth of the recorded history of the earth; beyond which, again, lies the infinite abyss of the unrecorded." *

That incalculable time has elapsed since the paleozoic deposits is evident from the superimposed strata.

The next ensuing era is now known as the mesozoic—old secondary series—cretaceous, jurassic, and triassic periods in the

* Le Conte, pp. 367, 368.

named order. The age is characterized by the appearance of saurians, birds, and mammals, and peculiar flora, and deposits of rock salt.

Old secondary or mesozoic.

Our object being simply to find time measures does not require a more particular consideration of this series, except as it bears on that point. The fossil life of the combined periods is exceedingly interesting both as to its flora and fauna; but this must be reserved for future consideration. The mesozoic strata measure several thousand feet in thickness. On the probable time required Dawson (*Earth and Man*, p. 195) says:

"Was the length of the mesozoic time equal to that of the paleozoic (which we have seen could not have been less than millions of years)? Measured by recurring cycles it was. In the latter period we find five great cycles, from the lower Silurian to the Permian inclusive. So in the mesozoic we have five also, from the triassic to the cretaceous inclusive. We have a right to reckon these cycles as ages or great years of the earth; and so reckoning them the mesozoic may have been as long as the paleozoic. But if we take other criterion the result will be different. The thickness of the deposits in the paleozoic as compared with the mesozoic, where these are severally best developed, may be estimated as at least four or five to one; so that if we suppose the beds to have been formed with equal rapidity in the two great periods, then the older of the two was between four and five times as long as the latter, which would indeed be only a little greater than one of the separate ages of the paleozoic. Either, therefore, the deposits took place with greater rapidity in the paleozoic, or that period was by much the longer of the two." For an exhaustive examination of the subject in a masterly scientific handling see Dawson, pp. 195–199. The probable fact is that the mesozoic period was less than that which immediately preceded, perhaps not more than

a fourth; but this on the most liberal scale of calculation would give it several hundred thousand years.

It was the age of the great reptiles, whose gigantic and grotesque form and corresponding power must have been the terror of ancient seas and lands as well. Their remains are exhumed and found in all the great museums in remarkable perfection. "There are now on the whole face of the earth only six large reptiles over fifteen feet long—two in India, one in Africa, three in America—and none over twenty-five feet long. In Wealden clay of the mesozoic eras and the lower cretaceous of Great Britain alone there are five or six dinosaurs twenty to sixty feet long, ten to twelve crocodilians and enaliosaurs ten to fifty feet long, besides pterodactyls, turtles, etc. Again, in the cretaceous of the United States alone, the fullness of the reptilian life was even greater, for one hundred and forty-seven species have been found, most of them of gigantic size. Among these were fifty species of mosasaurus, some seventy to eighty feet long; many dinosaurs twenty to fifty feet long." See Dana and Le Conte.

Next follows what is now named the cenozoic era—old tertiary—or age of mammals.

We are still far back in earth's annals. We have ascended through the corded archives of rock records miles in thickness. We have seen ages counted by millions of years come and vanish. We have climbed up stratum by stratum along whose corridors were piled the memorials of long since extinct species and genera of life. We have seen eras following eras and eons chasing eons; but we are still but approaching hints of yet undeveloped ages prior to the era in which we live. But we are advancing toward a climax. What it all means will be matter of future consideration, and how it bears on problems with which our age is rife. The cenozoic era, or age of mammals, is divided into two periods: (1) the tertiary and (2) the quater-

Normal age of cenozoic.

nary. Of the tertiary all the then existing mammals are now extinct, but some of the invertebrates of that period are still found. In the overlying quaternary most, though not all, of the mammalian species are extinct; but a large per cent of the invertebrates are now living. But long ere we reach the tertiary all of the *most ancient* life has disappeared. Thus the record shows how the reign of death has extended over all eons, and how not only generation has followed generation in the march of millenniads, but orders themselves have after hundreds of thousands of years of regnancy succumbed, and new orders have come to take their places. It is an amazing record over which uncounted millions of sun risings and sun settings have watched, but with only the stencil of erosion to keep the account.

Tertiary.

The tertiary era is divided into the eocene, miocene, and pliocene or pleistocene ages, characterized by varieties of mammalia and new species of flora over the regions where it prevails. Its chief seat in North America was the submerged portions of the continent south of the bases of the Appalachian chain and the basin below the mouth of the Ohio bending northward to the bases of the Rocky Mountains, including New Mexico, Arizona, and basins in Utah and along the Pacific coast line. Tertiary appears on the Atlantic shore in New Jersey and southward, but not further north, except on Martha's Vineyard Island, in all of which marine life is represented. In the Rocky Mountains are large deposits in fresh water basins. Some of these latter are very remarkable, notably those of the Green River basin, where the deposits are several thousand feet thick. They appear also in Oregon and other sections. The whole group is fully represented in different parts of Europe. The Mississippi probably during that period emptied into the great inland sea and lake basins in the interior plain region, as its present outflow cuts the deposits southward. There is but

little reason to doubt that the time of this era was much less than that of both the laurentian and paleozoic which preceded, but on the most liberal scale of discount it cannot have been less than scores of thousands of years. The climatic conditions were favorable throughout, and life was developed on an ascending scale and in great varieties, both vegetable and animal.

Keeping in mind that our object is not a treatise on geology, but is simply to take note of the era in sufficient fullness to give some idea of time measures, we dismiss the further consideration of this interesting era and refer the reader to any respectable work on the science for further and fuller information.

The upper pleistocene age in the series brings us to near proximity to the present, relatively to all the preceding formations.

Finally we come to the latest era, the quaternary. By slow uplifts, as indicated in shore lines on the sides of all mountain ranges, the tertiary seas and immense lakes in the basins of the continents, the seas and lakes which received the tertiary deposits, were emptied of their waters, and the present contours of continents and oceans were established and have remained substantially as we find them to this day. North America has undergone but little changes of surface since that period, but has been nevertheless the scene of great and peculiar geological history.

Quaternary or superficial.

The quaternary period is one whose changes are not indicated by marine sedimentation, but by superficial abrasions, erosions, and deportations by rivers, and by what is known in geology as drift, or glacial, agency. There have been local and marginal subsidences and uplifts, but not such as to note any great variation in the general contour of the earth—continents and oceans have retained their respective places.

Had a visitor come to our planet at the end of the tertiary era and made observation, and should he return now, he would detect similar shore lines and leading ranges of mountains and plains, and much the same flora and fauna, but with notable differences in all these respects. But we must not, therefore, infer that a small time has elapsed, or that the intervening history has been one of monotonous sameness. On the contrary, an age of marvelous changes has transpired and a wonderful chapter of history has been recorded.

The uplift which added the tertiary seas to the continents marked the beginning of a history of great oscillations of the earth's crust in both hemispheres, attended with extreme changes of climate in the higher latitudes, pushing arctic regions far toward the equator. To this fact may be traced the chief characteristics of the period. "The invertebrate fauna was almost identical with that still living, but the mammalia fauna was almost wholly peculiar, differing both from tertiary, which preceded, and from the present, which followed it." *

Glacial and postglacial.

The period is divided into epochs: (1) glacial, (2) postglacial, and modern or recent. These epochs were doubtless brief as compared with earlier eras.

It is not possible to fix precise lines of demarcation between the postglacial and recent. Dawson groups the whole series as postpliocene. Quaternary is sufficient as noting the period between the tertiary and the present.

Geikie says: "We have now arrived at the last main division of the geological record, that which is named post-tertiary, or quaternary, and which includes all the formations accumulated from the close of the tertiary period down to the present day. But no sharp line can be drawn at the top of the tertiary

*Le Conte, p. 513.

groups of strata. On the contrary, it is often difficult, or indeed impossible, satisfactorily to decide whether a peculiar deposit should be classed among the younger tertiary or among the post-tertiary groups. Accordingly, a classification of the quaternary strata has been adopted in which the older beds, containing a good many extinct mammals, have been formed into what is termed pleistocene, postpliocene, or glacial group, while the younger beds, containing few, are termed recent.

"Ultimately the northern part of the northern hemisphere was covered with snow and ice, which extended into the heart of Europe and descended far southward in North America. The previous denizens of land and sea were in large measure driven out or even in many cases wholly extirpated by the cold, while northern forms advanced southward to take their places. The reindeer, for instance, roamed in great numbers across southern France, and arctic vegetation spread all over northern and central Europe as far as the Pyrenees. After the cold had reached its climax the icefields began to retreat and the northern flora and fauna to retire before the advance of the plants and animals which had been banished by the increasingly severe temperature; and at last the present condition of climate was reached. The story of this ice age is told by the pleistocene or postpliocene formations, while that of the change which immediately led to the establishment of the present order of things is made known in the recent deposits.

"The evidence from which geologists have unraveled the history of the ice age, or cold episode, which came after the tertiary period in the northern hemisphere, may here be briefly given. All over northern Europe and the northern part of North America the solid rocks, where of hardness sufficient to retain it, are found to present a characteristic smoothed, polished, and striated surface. Even on crags and rocky bases that have remained for long periods exposed to the action of the

weather this peculiar worn surface may be traced; but where they have been protected by a covering of clay these markings are as fresh as when they were first made. The groovings and fine striæ do not occur at random, but in every district run in one or more determinate directions. The faces of rocks that look one way are rounded off, smoothed, and polished; those that face to the opposite quarter are more or less rough and angular. The quarter to which the worn faces are directed corresponds to that to which the striæ and grooves on the rock surfaces point. There can be no doubt that all this smoothing, polishing, grooving, and striation has been done by land ice; that the trend of the striæ marks the direction in which the ice moved, those faces of rock which looked toward the line being ground away, while those which looked away from it escaped. By following out the direction of the rock striæ we can still trace the march of the ice across the land.

"As the ice traveled it carried with it more or less detritus, as a glacier does at the present day. Some of the material may be left on the surface, but probably most of it was pushed along at the bottom of the ice. Accordingly, above the ice-worn surface of rock there lies a great deposit of clay and bowlders, evidently the *débris* that accumulated under the ice sheet, and was left on the surface of the ground when the ice retired. The deposit called bowlder clay, or tile, bears distinct corroborative testimony to the movement of the ice. It is always more or less local in its origin, but contains a variable proportion of stones which have traveled for a greater or less distance, sometimes for several hundred miles. When the stones are traced to their places of origin, which are often not hard to find, they are found to have come from the same quarter indicated by the striation of the rocks. If, for example, the ice-worn bases of rock show the ice to have crept from north to south, the bowlders will be found to have a northern origin.

The height to which striated rock surfaces and scattered erratic blocks can be traced affords some measure of the ice sheet.

"From this kind of evidence it has been found that the whole of northern Europe, amounting in all to probably not less than 770,000 square miles, was buried under one vast expanse of snow and ice. The ice sheet was thickest in the north and west, while it thinned away southward and eastward. Upon Scandinavia it was not improbably 6,000 or 7,000 feet thick. It has left its mark at heights of more than 3,000 feet in the Scottish Highlands, and over northwestern Scotland it was probably not less than 5,000 feet thick; when it abutted on the range of Harz Mountains it appears to have been still not short of 1,500 feet in thickness.

"This vast mantle of ice was in continual motion, creeping outward and downward from the high grounds to the sea. The directions taken by its principal currents can still be followed. In Scandinavia, as shown by the rock striæ and the transport of bowlders, it swept westward into the Atlantic, eastward into the Gulf of Bothnia, which it completely filled up, and southward across Denmark and the low grounds of northern Germany. The basin of the Baltic was completely choked up with the ice; so also was that of the North Sea as far south as the neighborhood of London. . . .

"Northern Europe must have presented the aspect of North Greenland at the present time. The evidence of rock striæ and ice-born rocks enables us to determine proximately the southern extremity to which the great ice crop reached. As even the southern coast of Ireland is intensely ice-worn the edge of the ice must have extended some distance beyond Cape Clear, rising out of the sea with a precipitous front that faced to the south. Thence the ice cliff swung eastward, passing probably along the Bristol Channel and keeping northward of the valley

of the Thames. That the northern ice moved down the bed of the North Sea is shown by the bowlder clay and transported stones of the eastern counties of England, among which fragments of well-known Norwegian rocks are recognizable. Its southern margin ran across what is now Holland, skirted the high grounds of Westphalia, Hanover, and the Harz, which probably there arrested its southward extension, for there is evidence that the ice swept round into the low lands of Saxony up to the chain of the Erz-Riesen and Sudeten Mountains, whence its southern limit turned eastward across Silesia, Poland, and Galicia, and then swung round to the north, passing across Russia by way of Kief and Novgorod to the Arctic Ocean.

"In Europe no distinct topographical feature appears to mark the southern limit reached by the ice sheet; this limit can only be approximately fixed by the most southerly localities where striated rocks and transported blocks have been observed. In North America, however, the margin of the great ice crop is prominently defined by a series of mounds of detritus which seem to have been pushed in front of the ice. These mounds, beginning on the coast of Massachusetts, run across the continent with a wonderful persistence for more than 3,000 miles. They form what American geologists call the 'terminal moraine.'

"The detritus left by the ice sheet consists of earthy, sandy, or clayey material more or less charged with stones of all sizes up to blocks weighing many tons. For the most part it is unstratified, and bears witness to the singular way in which it was tumbled down by the ice. In some districts it has been more or less changed in water, and this assumes a stratified character. The stones in the detritus, more especially when they are hard and are imbedded in a clayey matrix, present smooth striated surfaces, the striæ usually running along the

length of the stone, but not infrequently crossing each other, the older being effaced by a newer set. This character of striation points unmistakably to the slow, creeping motion of the land ice.

"But the bowlder clay, earths, and gravels left by the great ice sheet are not simply one continuous deposit. On the contrary, they contain intercalations of stratified sand, clay, and even peat. In these included strata organic remains occur, for the most part those of terrestrial plants and animals, showing that the ice again and again retreated, leaving the country to be covered with vegetation and to be tenanted by land animals, but after longer or shorter domination it once more advanced southward over its former area. These intervals of retreat are known as 'interglacial periods.' Probably they were of prolonged duration." *

We have been at the pains of presenting this somewhat extended extract from one of the most careful specialists for the purpose of showing both how the quaternary era is viewed by men who have made it a life study, and to show the grounds of their conclusions. On the general facts there is almost perfect harmony and accord among all who have given the subject attention. At present there is general agreement in the theory of the drift age. The facts seem to be plain and easily interpretable. For a more extended study, any who are interested in the subject can read to profit Le Conte, or indeed any respectable text-book in geology. As our object is simply to ascertain time measures we can pursue the subject no further.

With the facts before us we are constrained to admit that the data for computing the time of this period are not so satisfactory as are found in the earlier eras. The erosion and sedimentation by which the older strata were formed convey a more exact idea of the time employed. But no one can doubt that

* Geikie, pp. 456–461.

an immense period was consumed in the ice age; to say how long would be mere conjecture; many assert with confidence hundreds of thousands of years, and not without alleged facts to support them. It was a long period.

Since the recession of the ice age and the establishment of the present climatic conditions the earth over, there have been no oscillations to disturb or affect the general contour of the continents and oceans of the globe, and but slight local changes of its surfaces. There have been local marginal depressions and uplifts, modifying shore lines, elevations and depressions of land surfaces, volcanic eruptions covering large areas with lava and other erupted matter, drying up of small inter-continent bodies of water, erosion and deportation of rivers forming deltas and shore deposits, etc., etc., but no great epoch-making changes. The rocks and soils have weathered and the fauna and flora been more or less prevalent in sections, but all things remain substantially as they were—the rivers and even rivulets flow in the same channels, and the hills and mountains cover the same areas.

We have reached the modern age, the recent geological condition. It is impossible to measure its time limits. There are absolutely no data determinative in the premises. We cannot tell when the period began, when the glacial epoch ended, or how long the transition took. There are no facts, however, which demand, much less require, more than a few thousand years comparatively since the beginning of postglacial times.

We are acquainted with all the forces which effect present modifications. They are the same forces which have been always operative. The changes which have been wrought in the modern era have been slow and regular, and not sufficient to indicate more time than the age of man on this planet, or but little beyond it. This subject will be considered farther on.

We have thus cursorily, but with sufficient fullness for our purpose, surveyed the processes of universe construction as respects inorganic substances and phenomena as known to us. We have found that the whole is not within **our** reach by any instruments we have been able to employ, or any research possible to be made; that possibly the unknown is immeasurably vaster than the known both in time and space. Possible universes may have antedated the present; the present may be a reconstruction of antecedent creations. Other unsurveyed realms may reduce the known to an infinitesimal part of the whole. Of these things it is impossible to affirm anything; and mere conjecture is unprofitable. We are compelled to fall back on the admission that we can know but in part; but of one thing we are certain, that, making due allowance—the largest that can, in any reason, be demanded—for mistakes and exaggerations, the universe as we are able to know it is semi-infinite, by which we mean inconceivably vast both in measures of time and space; but at the same time that it is finite in both of these respects. It is a created and not an eternal something. There was a time when it began, and there is an outer void where it is not. Two things are inseparable from it: It has form. Form is finite. It exists in process. Process is finite; no series can be infinite, either in space or duration.

The nebular hypothesis may be a mere fancy. It is impossible to demonstrate its truth. It seems reasonable and may be true, but, whether true or not, it in no way unsettles the conclusions forced upon us of the two great facts established beyond question, that the history of the universe extends backward over a depth of time incomputable in years, and out over spaces immeasurable in extent.

We have found, taking our own earth-home, proof absolute of a history written in its rocks which began many, many

millions of years ago. The record, though blurred and effaced on many pages, is nevertheless decipherable with more or less clearness from beginning to end. It is continuous and coherent. There is the ante-preface in the unstratified under floor. Each leaf of the overlying strata recites its story until we reach its latest page to-day. We begin with the dawn and march with the growing day. There are epochs and ages, each having its own story of wonders; birthdays of rivers and mountains and oceans and continents, and graveyards in which they were buried; beginnings and ends of races and dynasties, which rose and flourished in ancient seas and over ancient continents, and which perished long before coal measures were piled away in the mountains; races of animalcules so diminutive as to be discoverable only by the microscope, and races of monsters of the sea and land; species and genera which have no living representatives. As we survey these ancient halls and corridors, hung thick with the memorials of extinct empires of life which came and reigned and vanished millenniads before our day, we are filled with awe and wonder, and close the enchanting volume with a feeling of reverence of the almighty Power which is manifest in all and through all, with whom millions of years are but as a passing moment. These are parts of his ways, but the remainder is hidden from our view. Our survey is in the realms of time and space—a fraction of each; but eternity, infinity—who can speak of these?

It remains, before we take leave of this study of the inorganic universe, that we give more direct attention to the forces, or modifications of force, which are found to be at work in it, which have made it what it is. As yet we have but contemplated it in the two aspects of extent in space and time, magnitude and age, with but incidental references to other aspects.

We now turn attention to the forces which have factured it, and which are now manifested in its processes and ongoings. Forces.

It has been shown that it did not always exist—that it has come by long process to its present state. Force is that energy by which the processes and changes of state and relation among the elements of the inorganic universe are effected. It is discoverable, not as physical entities are by immediate sense perception, but by changes wrought in the collocations and apparent in the motions of material entities or substances. It is thus defined lexically: "Any action between two bodies; or, more fundamentally, the energy exhibited in any action between two bodies which changes, or tends to change, or might change their relative condition as to rest or motion; or, more generally, which changes, or might change, any physical relation between them, whether mechanical, thermal, chemical, electrical, magnetic, or any other kind, affecting their state and condition; as, the force of gravity, cohesive force, centrifugal force, etc."

The most primitive and fundamental form of force is that energy by which material atoms were themselves created or raised into existence, but for this the term power is usually employed. That such a force is manifested in the existence of the inorganic universe is the necessity of rational thought; but as it is not among the observed facts it is not here treated. Of that amazing power we can form no conception—it can be nothing less than eternal and infinite. Its home is in the unfathomable depths of the divine nature. We behold proof of it in the existence of the atom no less than in the existence of the vast aggregates of the created systems as we have described them in the foregoing pages. To create an atom implies the same measure and mode of energy which is demanded to build the universe in its utmost extent. Creative force.

The entire inorganic system is found to be the resultant of dis-

crete modes of force exerted in the atomic elements—an energizing in the infinitesimal components—arranging, combining, collocating, positing, relating, and moving them in every variety of way in which they interact together and upon each other—which might be properly styled the building forces of the universe, or, more properly still, the modes of energizing for the production of the elements, and in the elements employed by the master builder in bringing it to its present state. For the fuller discussion of these matters the reader must give himself to the study of some treatise in physics for the facts and the modes of energy called forces by which they are wrought together into the marvelous system. It is aside from the object of this discussion to pursue the subject farther here.

There are some broader facts of the system, as exponential of the power operating in it, which deserve special attention. We have already seen its vastness, the amazing magnitude of its bodies, the incalculable extent of space which they occupy. Incidental allusions have been made to other aspects which deserve some more particular attention. We refer specially to the motions and harmonies of these bodies in their space relations, exponential of the wondrous skill and power manifested.

Among the wonders deserving special mention is the sus-

Harmony of the universe.

tained harmony of the vast system—balanced on emptiness, that is, in absolute void, with no supports or foundations but the will of its Founder—its exact relations maintained through infinite ages—held by unseen power so that the parts do not vary or collide or interfere.

If they were absolutely motionless, each occupying the same precise space, in the same exact position of fixedness immutably, the marvel would then be great; but it is infinitely greater when we consider their complex motions together with their sustained harmony, careering over wide areas, circle

within circle, orbit within orbit, with varied velocities yet sustained harmony amid the complexity. Think of some of these velocities which are known—that of our own planet, for instance —a compound motion of 1,000 miles on its axis every hour without variation through all eons of time, twelve times faster than the velocity of a cannon ball; then its still more wonderful velocity in its orbit of more than sixteen miles each second of time, more than seventy times the speed of the cannon ball maintained with perfect exactness through uncounted ages. *Ab uno disce omnes.*

Velocities of the system.

The entire universe is alive with similar activities, the great globes and central suns rushing through space at such inconceivable rates of motion forever, yet maintaining exact and undisturbed orbital relations, and as to each other fixity of position.

DAWN OF THE LIFE SYSTEM.

IN the survey which we have made our chief aim has been to bring vividly before our minds the facts and processes of the inorganic universe. Frequent allusions have been made to another and totally different and distinct system—the universe of life, or the organic universe.

We now return to a brief statement of this realm. The recital will bring us to an entirely new set of facts. The organic universe interblends with the inorganic. Beginning much later, it runs along with it, and its memorials are built into and with it. The strata in the inorganic, piled up through the ages, determine the exact period when the organisms lived whose casts are found therein, and so the time when life was introduced into the system; and the medallions of its lowest and ever-advancing forms show the exact point of time when they were successively introduced; the period through which they existed, and the time when they vanished and new orders took their place. Thus the entire history of life is written and preserved in the rock-built crust of the earth itself.

The marvels of this new order (relatively new, for life dawned millions of years after the inorganic realm was initiated and not until it had been fashioned into orderly groups of worlds) will be found to be conditioned on the old and built out of its material, the one preparing the way for and necessary to the other, in a multitude of economies. The new order demanded new creative forces. There was nothing in the old to produce the new. The new was in no sense an evolution from or of the old. There was not a tendency in the one to the other, and never is or can be.

This is now admitted even by avowed evolutionists. We emerge upon a new order of existence not simply as to fashion but as to kind, in fact a new creation, in manifold degrees superior to all that preceded it, and but for the purpose of which the old would never have existed. It is the new which interprets the old and puts in it all its meaning.

Had the creative process stopped with the building up of the inorganic universe as we have found it, it would have been a sublime manifestation of skill and power. The proof would have been complete of a great Being who possessed these attributes. It would also have furnished proof of the eternity and spontaneity of the great Artificer. To discover more of his nature and find in him other attributes he must do more: the scene of creation must be extended so as to include other kinds of products than unliving atoms—azoic worlds, however magnificent in scope of space and time. He may begin and linger myriads of eons in laying foundations and building world structures, but some time, if there be in him more than mere power and architective skill, he must advance in the quality and kind of creative products. The outcome must be waited to reveal his deepest nature, which will come more and more into view as the work unfolds and advances.

We have seen on unquestioned grounds of scientific discovery that immeasurable ages passed before creation indicated anything but lifeless worlds, magnificent in design and spread, but tenantless—a house without an inhabitant, a vast exhibition of skill and power without a mind to behold it or enjoy it save its great Author. The order is natural—the house before the inhabitant.

We have seen that the antecedent universe, that is, the inorganic, did not produce itself; that the vast and matchless forces that play within it, and are constructive of it, are forces exerted by a living agent in free spontaneous output; that entire, it had

beginning, and of necessity is traceable to an eternal Being whose product it not only probably is, but necessarily must be.

Why so long?

It may be matter of wonder and to our finite intelligence beyond comprehension, that the World-builder should have occupied such immense ages in mere inorganic processes; but it is clear that he did. He unquestionably built the worlds, no less than the curious and diverse orders of life, and *vice versâ*. The facts all show his handiwork in different ways, but no less explicitly, and are utterly inexplicable without him. It is no part of the purpose of this treatise to discuss that point. It is certain that he did occupy immeasurable time in the construction. The facts already alleged demonstrate this.

The arrangements and processes in the inorganic show clearly that they were not an end, but a means to a far distant end. The advancing ages all through unfold new conditions to which the old and older and oldest were preparative. The atom prophesies worlds hidden in the womb of the future. Each unfolding stage works to one to follow. One end and a deft plan mark each succeeding era—each was indispensable to that which immediately succeeded. If ages were consumed in preliminary work the temple of life to be builded was in such grandeur of reach and purpose as not only to justify almost infinite time, but such that, considering the eternity of the Builder and the coming eternity for which he built, haste, or even less time, would have been unseemly and out of proportion.

We have been contemplating semi-eternities; let us not lose sight of the fact that the building in process of erection, yet incomplete, is for eternity, and each part essential in some way to the eternal edifice—the inorganic for the organic—the organic, as we shall yet see, for another and higher dome in the process of erection, but only begun and never to end.

There is absolute contradiction in the supposition that a force

which necessarily acts is or can be eternal, and therefore the supposition is necessarily false. If this postulate is true it demonstrates that all active force is temporal, and also that its source is eternal and also free, or nonnecessitated. That the postulate is true, and that the contrary of it cannot possibly be true, is apparent for the reason that exerted force is cause of effect; but effect is temporal, or something which has origin or beginning. But if the effect begins the action which causes it must also begin. Action, in fact, is effect, which can only occur in time. But as no action can begin without an actor the prime cause must himself be unbegun or eternal, and must also be free, since if the act were necessary there never could have been a time when it was not. Force exerted to produce change is, therefore, of necessity temporal, and the agent thereof is of the same necessity eternal and capable of free spontaneous action. Thus it appears that all the forces operative of change in the universe are forces put in action by a free eternal cause, or forces which have their source in God and are free and spontaneous energizings of his inherent power, that is, of his will. If these reasonings and postulates be true—and we cannot see how they can be doubted—it follows that evolution reduces to a series of changes or effects, all of which are products of a free exercise of power by God himself, by which one effect follows another, the entire series forever tracing to him as prime cause, or as so cause that they could not exist without him, and that they do exist by him—by an exercise of his power.

Nothing is more certain than that the entire inorganic universe system is traceable to one omniscient mind as conceiver or inventor, and one omnipotent will as creator, constructor, and administrator. Whole and complete it emanates from one source. There are no forces in any entities that are not derived, or that operate to any ends that are not determined and directed or energized by Him who planned it. There is nothing in it of

which he is not author. The things made set up no new lines on their own account by any independent powers which they possess. There are not two or an infinite number of masters in the universe system each carrying on business on its own account—evolving results from itself. Anything and everything which created things seem to do are but effects wrought by their Author through them by modes of energy exerted in them, not by them without him. He created and he destroys. All ends are his ends, and all means are his means. Take him away, nothing would remain. Apart from his will no powers or forces or entities exist. By his will entities exist. By his will entities are operated to uses and ends. By his will the system rolls on through the ages in a consecutive and progressive unfolding, one stage serving as condition to another and as medium of a new mode of energy thereto. From base to finial he is the pervasive agent and the only. It is his universe, and all that is within it is his product.

His fiat brought forth the atoms and spread them out over the infinite void. He collocated them and massed them into worlds and world systems. By him the innumerable stars hold their places and forever shine in the vault of heaven. By him the oceans have their tides and rivers have their courses. By him the elements are compounded and transmuted and set in order. The storms and lightnings are his messengers. He holdeth all in his hand that they may be the servants of his will. From the beginning through all the ages he guides and directs all motions and all changes in all worlds and in every element, being forever present with and in all upholding them with his power, and never apart from any of them for a single moment. Nothing is left to run wild or loose, the sport of accident, to mar his plan or introduce confusion into the works of his hands. His decree is law; his will the energy which compels obedience thereto.

THE ORGANIC UNIVERSE.

WE have in the preceding pages passed under review some of the more conspicuous and well ascertained facts of the inorganic universe, more especially of its extent in space and time, and of the method of its development from the atom to its present condition. Of the general correctness of the statement of facts therein set forth there remains no more any doubt among intelligent and informed people, however they may, by reason of the recency of their discovery and their opposition to long regnant opinions, excite astonishment. The evidence on which they stand it is not probable will ever be shaken. Newly discovered facts and increasing light will no doubt improve our knowledge and modify some of our conclusions, but the main facts will admit of no dispute or correction.

One point remains open to debate: how to account for these marvelous facts. There are two theories competing for the mastery. They are respectively called Evolutionism and Creationism.

Sheer evolutionism renders the following explanation, which is supported by an array of great names, namely, that the crass matter substance of the universe has existed eternally, and by virtue of inhering forces, excluding any purposing agent, the universe as it now exists has been evolved, each antecedent phase accounting for that which immediately follows until the finial is reached, sufficient time being all that is required to transmute the crass stuff into the topmost result.

Creationism posits an eternal intelligence at the starting point, and makes the universe from its beginning, throughout

all its stages, a product of his energizing as a will, each successive stage serving as a condition to a higher end or final purpose. It denies that any one thing in the series is cause of any other thing, but holds that there is a relation between the catenated parts such that each preceding part is means to that which follows, or medium for energy exerted in it thereto, the agent being the same throughout the series, and the whole constituting an ineffable unity, purposed in all its parts—the cause immanent in all the parts forever ; so that there is no energy but his, and nothing exists or does anything apart from him. There are no so-called natural forces of which he is not source.

The theory of evolution is especially put forward as explanatory of the organic universe. For a full discussion of the principle as applied to that end we refer the reader to our second volume in this series, *Cosmic Theism*. It will be found on pages 298–358 inclusive.

As our aim here is mainly to present the facts of the universe in its threefold form, the inorganic, organic, and higher spiritual, it would be aside from our plan to further notice the subject of evolutionism here.

By the organic universe we scarcely need say is meant the universe of life in material forms; life being simply a word to describe that specific kind of energy which is displayed in the origination of the individual form, whatever that may be, and in the method of its propagation and preservation.

In the merely organic no new entity is created, but simply a new mode of force is exerted by the builder of the organism out of previously created substance. Creative agency is manifested, not in every new adjustment or construction of matter, but then only when a new entity is posited. Mere energizing

is not necessarily creative. This delicate but real discrimination is clearly made in the scriptural account of creation. Energy in things constructive of their fashion, and energy productive of substances themselves, describe radically different modes of activity and different methods of bringing about results. The one is originative, the other is simply constructive; but the energy in both cases is traceable to the same source. Whether the energy exhibited be originative of a new being or entity, or merely a fashioning of previously created substance, it is in both cases alike attributable to the same agent working in diverse ways to diverse ends.

No term plays a more important part in the scientific and scientifico-theological discussions of to-day than this term force. We constantly hear of matter, spirit, force, law. It is impossible to discuss the problem of the universe without them. They have appeared all along the ages of thought. They cannot be dismissed or ignored.

By the term force, as stated in a former page, is meant a mode of agency which is exerted when changes of any kind take place, by whose action the change is effected. It is thus not a thing in itself, but is exertion of power possessed by a being or by that which exists in order to an end. In God it is the original and unoriginated power which he possesses, by the exercise of which he creates and conducts the universe, and takes the name in theological thought, and philosophical as well, of Omnipotence. It is seen to be a reality by seeing the things which appear to sense and by consciousness. All observed changes declare it as cause. There is no dispute on the point that God only possesses creative force. In consciousness man knows that he has this endowment, so far as working changes in things is concerned, namely, that he has power by which he produces changes in the movements of his body, and indirectly

on surrounding things using his body instrumentally. Now we perceive changes passing on and in the things which we behold which we know that *we* do not produce, and we know that they are produced by some agent or being who exerts force just as we know that the changes which we produce are effected by an exercise of power which we possess and exert.

The question is, Whence the force, or what or who is it that exerts the force, which we discover in the ongoing or changes which we behold?

This is the fundamental question around which all the contests of to-day are being waged.

Certain effects are attributed to force or forces apparently existing in and exerted by things, and these are called natural forces. Certain other effects are attributed to personal agency —man or God; and these are called personal, or by some supernatural effects, or effects not caused by natural forces. It is easy to point out the grounds of this distinction.

Dr. Miley has written with the usual carefulness and learning which distinguishes all his utterances in his recent work, *Systematic Theology:* *

Relation of the question to providence.

The question of natural forces, such as we call mediate or secondary causes, deeply concerns the doctrine of providence. Of course, the question here reaches beyond matter as being, and specially respects its orderly forms. It is only in these forms that forces emerge for rational treatment. If there be natural forces, then the mode of providential agency is in their support, in determining the collocations of matter for their efficiency, and in co-working with them for the attainment of chosen ends in the cosmos. If there be no such forces, then God is the only efficience within the physical realm. No exception can be made in the case of human agency. It is true that man has greatly changed the face of the

* See vol. i, pp. 318–326, which we quote in part.

physical world, but he has no immediate power over material nature, and can work only through existing forces, which, on the present theory, are purely modes of the divine energizing. If this theory be true, then all the forces operative in the physical universe, and none the less so the forces through which man works, are the power of God. There is a profound distinction between a divine agency working through natural forces and a sole divine efficiency which determines all movement and change in the physical universe. So profoundly does the question of natural forces concern the doctrine of providence.

There is no unity of view on this question. Not a few deny all secondary causality and find in God the only efficient agency in material nature.* Seemingly the present tendency of theistic speculation is toward this view. There is, however, no determining principle. The names given in the note represent widely different schools of religious thought, while among them are theologians, philosophers, and scientists. But others of the same schools hold just the opposite theory. It thus appears that neither theology nor philosophy nor science necessarily determines one's view on this question. It is here that the treatment of providence is implicated with questions of physical science. This implication rather obscures than clears the question. Nothing is more loudly trumpeted than the very great, and recently very rapid, advancement of physical science. Its achievements are specially noteworthy. After all, the uncertainty and diversities of view on the question of physical forces deny us all light on the question of providence. Physical science within its own limit is purely

Present tendency of thought.

* "Dr. Samuel Clarke, Dugald Stewart, John Wesley, Nitzsch, Müller, Chalmers, Harris, Young, Whedon, Channing, Martineau, Hedge, Whewell, Bascom, Professor Tulloch, Sir John Herschel, the Duke of Argyll, Mr. Wallace, Proctor, Cocker, and many among the ablest recent writers have defended this view." —McClintock and Strong, *Cyclopædia*, art. "Providence."

empirical, and therefore cannot reach the secret of force. Reason imperatively affirms an adequate force for all the movements and changes in physical nature, but what that force is, whether intrinsic to matter, or extraneous and acting upon it, or purely of the divine energizing, empirical science cannot know. We think that the question is beyond the reach of metaphysics. It is not clear to our reason that physical nature is in itself, and under all collocations of material elements, utterly forceless.

In principle occasionalism.

The theory which denies all secondary causality in material nature, and finds in God the only agency operative in the physical realm, is known in philosophic speculation as *Occasionalism*. The principles were given in the philosophy of Des Cartes, but were more fully developed and applied by his followers. Primarily the doctrine was more directly applied to the bodily action of man. The mind could not act upon the body. A volition to move the arm was not the cause of its moving, but only the occasion on which the divine power determined its movement. In its broader application the doctrine denies all interaction between material bodies. No one can determine any change in another. The implication is the utter powerlessness of physical nature, and that all changes therein are from the divine agency.*

Implications of the principle.

This question is entirely above the plane of empirical science. Metaphysics cannot resolve it. The Scriptures are silent as to any decisive judgment, though seemingly against the doctrine. Yet the question is open to rational treatment in view of its contents. The doctrine is the utter forcelessness of physical nature, and that God is the only force operative therein. We think it open to weighty objections. We need not urge what others have urged, that it imposes an immense drudgery upon God. The force of this objection is

* Morell, *History of Modern Philosophy*, p. 120.

only seeming. There can be no drudgery for that which cannot weary; hence there can be no drudgery for omnipotence. This occasionalism must not be allowed any office which the doctrine really denies it. The occasions are not only without all force, but are in no proper sense conditions of the divine agency. The two are merely coincident in time. Matter has no instrumental quality, and is really reduced to a blank. It must be denied all the qualities, primary as well as secondary, with which philosophy has been wont to invest it. With these properties it could not be forceless. Gravitation, cohesive attraction, chemical affinity, magnetism, electricity, without force in themselves, are simply coincident with the divine energizing. The lightning can have no part in riving the oak, the projected ball no part in breaching the wall, for any such part is possible only with the possession of force. The massive cables of steel which seemingly uphold the Brooklyn Bridge have no natural strength of support, but are the mere occasion of the divine energizing as the sustaining power, and for which, so far as any natural strength is concerned, threads of cotton might answer as well. Indeed, if this occasionalism be true, there is no natural weight of the bridge, which is possible only with a natural force of gravitation, and but for a mighty downward pressure of the divine hand there would be no weight to sustain.

Further implications.

In the implications of this doctrine there is no natural fitness of physical conditions for vegetable production, none in organic structures for any function of animal life. The "tree planted by the rivers of water" has no natural advantage of growth and fruiting over the tree planted in the most arid and barren earth. The richest harvest might spring as readily from the sand of the desert as from the field of richest soil. The stomach has no more natural fitness for the digestion of food than the dish in which it is served. The

system of nerves and ligaments and muscular tissue, so wonderfully wrought in the living body, has no natural fitness for animal movement. The structure of the eagle gives no natural strength for flight, while there is no reaction of the air against the stroke of his wings. All this must be true if there be no forces of nature. There is no proof of such a doctrine; and in the light of rational thought the extravagance of its implications is conclusive against it.

The mystery of natural forces is no valid objection against their reality. We know not how they act. This, however, is no peculiar case, but a common fact respecting the operation of force, whatever its nature. How there can be interaction between material entities, or how gravitation can act across the spaces which separate the planets from the sun, we know not. Our own personal energizing through the will is specially distinct and clear in the light of our consciousness, but only as a fact. How we thus act is as hidden as the action of gravitation across such vast spaces. Surely we cannot know how God puts forth power. There is no profounder mystery than that the energizing of his will in the purely metaphysical form of volition should act as a ruling force in the physical universe. We escape no mystery by denying all natural force and finding in God the only agency operative in the material realm.

Tendency to idealism and pantheism.

It is a weighty objection to this occasionalism that it leads to idealism and pantheism. As a forceless world can have no effect upon our experiences, for us it can have no reality. "The outer world is posited by us only as the explanation of our inner experiences; and as, by hypothesis, the outer world does not affect us, there is no longer any rational ground for affirming it."* The logical result is idealism. "In this one affirmation, *that the universe depends upon the productive power of God not only for its first existence, but*

* Bowne, *Metaphysics*, p. 116.

equally so for its continued being and operation, there is involved the germ of the several doctrines of preestablished harmony, of occasional causes, of our seeing all things in God, and, finally, of pantheism itself, the ultimate point to which they all tend." *

The reality of physical forces does not mean their sufficiency for either the origin or the ongoing of the cosmos. There is still an ample sphere for the divine agency in supporting these forces, and in determining the collocations of material elements which are the necessary condition of their orderly efficiency. A true doctrine of providence must accord with such facts—the reality of natural forces, and their dependence upon God for their orderly working. Hence, as previously noted, the true doctrine must widely differ from any one constructed on the assumption of an utter forcelessness of physical nature. For the true doctrine we shall appropriate the statement of a recent excellent work. It contains a few words seemingly not in full accord with our own views, but is so good as a whole that we omit all exceptions. "The theory which seems most consistent with all we know of God and nature is that which supposes the Creator to have constituted the world with certain qualities, attributes, or tendencies, by which one part has a casual influence on another, and one state or combination of parts produces another, according to what we call laws of nature, the result being the coordination and succession of events which we call the operations of nature. At the same time all nature is pervaded by the living presence of God, sustaining the being and operations of the world he has made and governs, retaining a supreme control which may at any point supersede or vary the usual course of natural causation. Ordinarily he never sets aside the causal qualities of nature nor leaves them to themselves. This is the reconciliation, if any were needed, of the primary and secondary causes. God is imma-

Theory of Providence.

* Morell, *History of Modern Philosophy*, p. 120.

nent in natural causation, as truly and as necessarily as in natural being, in the operations as in the existence of matter or mind." *

Providence and the uniformity of nature.

Any inference from the uniformity of nature against a providential agency within the sphere of physical forces is utterly groundless. The two are not only entirely consistent, but the latter is the only rational account of the former. The denial of such consistency must either assume an absolute uniformity of nature as the determination of physical forces which leaves no place for the divine agency, or that such agency must be capricious and the cause of disorder. There is no ground for either assumption. If the processes of nature are wholly from the energizing of a blind and purposeless force, there is no guarantee of an absolute uniformity. For aught we know there may have been great variations in the past, and the near future may bring an utter reversion of the present order of things. We could know the contrary only by a perfect knowledge of the blind and purposeless nature assumed to determine the order of existences, which is for us an impossible attainment. "Whether the members of the system will always continue, or whether they will instantaneously or successively disappear, are questions which lie beyond all knowledge. We do not know what direction the future will take in any respect whatever. The facts in all these cases depend upon the plan or nature of the infinite; and unless we can get an insight into this plan or nature, our knowledge of both past and future must be purely hypothetical." †

Uniformity not from nature.

Such result is inevitable if the infinite or ground of the finite is assumed to be a blind and purposeless nature. There is no a priori necessity of uniformity in the working of such a nature. When Mr. J. S. Mill says, "I am

* Randles, *First Principles of Faith*, pp. 232, 233.

† Bowne, *Metaphysics*, p. 139.

convinced that anyone accustomed to abstraction and analysis, who will fairly exert his faculties for the purpose, will, when his imagination has once learned to entertain the notion, find no difficulty in conceiving that in some one, for instance, of the many firmaments into which sidereal astronomy now divides the universe events may succeed one another at random, without any fixed law," * he fully admits that the orderly course of nature is no necessity of physical causality, and hence that such order is entirely consistent with the agency of a divine providence. When by such a putting of the question Mill would unsettle the law of causation, that every event must have an adequate cause, he utterly fails. In the necessity of thought the movement of worlds at random, or without any fixed law, would no less imperatively require a cause than the movement of worlds in the order of a system. However, the axiomatic truth of causation is only a formal truth, valid for all events but without the determination of any, while events themselves, with their respective causes, are matters of empirical or logical knowledge. It remains true that there is no absolute uniformity of nature which must exclude the agency of a divine providence.

In the light of reason, as in the sense of Scripture, the providence of God is the ground and guarantee of the uniformities which the system of nature requires. The requirement is specially for the adjustment of the physical sphere to the living and rational spheres. The physical, however complete its mechanical order, has no rational end in itself, and must find such an end in the interest of sentient and rational life. "There only, where the possession, the preservation of being is felt, can existence be considered as a good, and consequently as an end to which a system of means is subordinated. What does it really matter to a crystal to be or not to be? What

Providence the ground of uniformity.

* *Logic*, book iii, chap. xxi, sec. 1.

does it matter to it whether it have eight angles in place of twelve, or be organized geometrically rather than in any other way? Existence having no value for it, why should nature have taken means to secure it? Why should it have been at the expense of a plan and a system of combinations to produce a result without value to anyone, at least in the absence of living beings? So, again, however beautiful the sidereal and planetary order may be, what matters this beauty, this order, to the stars themselves that know nothing of it? And if you say that this fair order was constructed to be admired by men, or that God might therein contemplate his glory, it is evident that an end can only be given to these objects by going out of themselves, by passing them by, and rising above their proper sphere." * As in the plan of God the physical system was constituted as preparatory to the coming of sentient and rational existences, so its orderly preservation is for their sake. "Physical and mechanical things being in a general manner connected with finality by their relation to living beings, we conceive that there may thus be in the inorganic world a general interest of order and stability, conditions of security for the living beings." † With such an original purpose in the constitution of the physical system, there is a manifest reason for the providence of God in its orderly conservation.

Error of contrary view.

Thus the providence of God, so far from being in any contrariety to the orderly course of nature, is in fact the ground of its uniformities. The contrary view arises from the false notion that a divine agency within the course of nature must be capricious and disorderly. Nothing could be more irrational. Nothing could be more utterly groundless than any inference from the orderly course of nature that there can be no providential agency therein. "For when men find themselves necessitated to confess an Author of nature,

* Janet, *Final Causes*, pp. 156, 157. † *Ibid.*, p. 159.

or that God is the natural Governor of the world, they must not deny this again, because his government is uniform; they must not deny that he does all things at all, because he does them constantly; because the effects of his acts are permanent, whether his acting be so or not; though there is no reason to think it is not." * We may add the noble words of Hooker, as replete with the same ideas: "Now, if nature should intermit her course, and leave altogether, though it were but for a while, the observation of her own laws—if those principal and mother elements, whereof all things in this lower world are made, should lose the qualities which they now have—if the frame of that heavenly arch erected over our heads should loose and dissolve itself—if celestial spheres should forget their wonted motions, and, by irregular volubility, turn themselves any way as it might happen—if the prince of the lights of heaven, which now as a giant doth run his unwearied course, should, as it were through a languishing faintness, begin to stand still and rest himself—if the moon should wander from her beaten way, the times and seasons blend themselves by disorder and confused mixture, the winds breathe out their last gasp, the clouds yield no rain, the earth be defeated of heavenly influence, the fruits of the earth pine away as children at the withered breast of their mother, no longer able to yield them relief—what would become of man himself, whom these things do now all serve?" † All such dissolutions in the physical system would be utterly indifferent but for the interest of sentient and rational existences; and God, who constituted that system for the sake of such existences as its finality, ever maintains its uniformities in their interest. This is the work of his providence in the conservation of the orderly forms of matter.

In passing from the lifeless to the living we reach a higher

* Butler, *Analogy*, part i, chap. ii.

† Hooker, Works (Oxford ed., 1793), vol. i, pp. 204, 205.

order of existence. From the highest chemical and crystalline forms of matter there is still a high ascent to the lowest forms of life. In the living organism there is a new element or force, and one far higher than any force of nature previously operative in the physical history of the world. Life is at once a reality and a mystery. The mystery cannot conceal the reality, nor the reality unfold the mystery.

No empirical cognition of life.

Whatever be the nature of life, it is too subtle for any empirical cognition. Neither the scalpel nor the microscope can reach it. Yet it is not on this account any less a reality. It is a reality for our reason just as other forces, which, however manifest in their effects, never reveal themselves to any sense-perception. Gravitation, cohesion, chemical affinity, magnetism, are such hidden forces. There can, however, be no question respecting their reality. They are everywhere operative in nature, and the aggregate of effects ever resulting from their agency allows no such question. So the vast aggregate of vital phenomena, so manifold and marvelous in form, can allow no question respecting the reality of life. As by an imperative law of thought we require a force of cohesion for the compacting of solid bodies, a force of chemical affinity for the compounding of discrete elements into concrete forms, and a force of gravitation for the orderly ruling of the heavens, so do we require a vital principle or force for the many facts ever appearing in the sphere of animate nature. This requirement gives us the reality of life.

All force a mystery.

The reality of a vital element or force is not the explanation of its nature. The mystery remains. This fact, however, is not peculiar to life, but is common to all the forces of nature. No one pretends to any explanation of the inner nature of either gravitation, or cohesive attraction, or chemical affinity, or magnetism. "Astronomers consider gravitation the unknown cause of the movement of the stars; I con-

sider life as the unknown cause of the phenomena which are characteristic of organized beings. It may be that both gravitation and life, as well as the other general forces, are merely as x, of which the equation has not yet been discovered." * In all these cases, however, the mystery is still the nature of the cause, not its reality.

As the cosmos itself, so life must take its place under the law of dependence. Neither its spontaneous origin nor its self-sufficiency for the continued facts of vital phenomena is in any sense an implication of its reality. For the existence of life and the realm of its activities, reason requires the interposition of a divine agency. Spontaneous generation has often been asserted, not, however, as a fact proved, but as the implication and requirement of a purely naturalistic theory of evolution. The absence of all proof of such an origin of life is admitted. There is still for mere science the impassable gulf between the lifeless and the living. God who said, "Let there be light," must also have said, "Let there be life." Only in such a divine fiat could life have its origin.

No self-sufficiency of life.

Even such an origin of life does not give us any insight into its nature; though it does give us the idea of a living organism, even if in its germinal incipiency. We can have no idea of life apart from an organism. It is the sense of Scripture that the beginning of life was in organic forms. It is equally the sense of Scripture that life was to be perpetuated through a law of propagation.† Such is the divine law for the realm of life. But it does not mean that life itself as thus initiated should be sufficient for all the future of this realm. We should rather find in the facts the proof of a divine agency than the intrinsic sufficiency of life itself for such a marvelous outcome. This view is fully warranted by the wonderful complexities and correlations of part with part in the

* Quatrefages, *The Human Species*, p. 7.

† Gen. i, 11, 22, 28.

living organism. It is not thinkable that life itself, without any higher directive agency, could weave the elements of matter into such marvelous forms. There must be a divine providence in the realm of life.*

The view we hold on this important subject is the following: First, all things that exist, exist by the agency of God. His permanent agency is as necessary to their continuance as it was to their initiation. Either this or the universe may now exist and exist forever and carry forward its processes without any further exercise of divine agency. If this be so the ground of its present existence and changes is in itself, and not in God. Were it possible to conceive of him as dead or nonexistent it would remain.

If, further, we conceive that in the things made were shrined what are called the natural forces to which we ascribe the processes of what we call nature, then these forces would go on and work all the changes and ongoing which we ascribe to them the same without God as with him. The universe would be just what it is if God had withdrawn from it when the so-called natural forces were created, or when matter, which is said to contain and exert them, was created. They have, in fact, made the built universe. God only made the material.

Either this or his existence in and coaction with them is necessary.

But we may look more closely still. Are these so-called natural forces things, or are they modes of energy exerted in things? or do the things act themselves?

Do these so-called natural forces act themselves? If so, in what sense? The accepted theory is that the natural forces act necessarily or by necessitation. What does that mean? Can it mean anything else than this, that when a so-called natural force acts it is compelled to act as it does, and the thing has no power

* See Fleming, *Vocabulary of Philosophy*, terms "Force," "Power," "Agency."

to restrain or change its action? But what is it that compels it? Is it said that it is so made; that is, it is in its nature? But what so made it? Is it answered, God? Then God creates its necessity; that is, God necessitates it. Then the necessitating agency is God, and the thing is simply the passive recipient. Can it be doubted that this is so in the inorganic universe? If it cannot be doubted, then the inorganic realm exists by a force that is not in it, and of which it is simply the passive recipient. There are, then, no natural forces, and when the phrase is used it means merely this, and can mean nothing else, that God is immanent in things, and by his direct agency produces all the changes which take place in them by a permanent necessitating exercise of energy. We ascribe the agency to the things we behold, simply because we always observe it working uniformly in them. The mode is a fixed mode—we call it a law, and say that it is according to the nature of things; that is, things act according to their law. Now, who made the law? Whose law is it? Who discerns the law? Who compels the obedience to the law? There can be but one answer to these questions.

God is thus seen to be the necessity of nature. All its apparent self-activity is but the impact of his will; always imminent in it, always upholding its existence and necessitating its changes.

The same conclusion is arrived at in another way. No one but an atheist doubts or denies that God is the author of nature—the whole of it. There is nothing self-made. Well, now, this so-called nature works out an idea, or, more properly, is made after the pattern of an idea, and is operated to fill out this idea. Whose idea? The idea of him who made it. Does nature apprehend the idea of its Maker? Does it determine itself to fill out the idea? No one can imagine anything of the kind. But the so-called forces of this made thing do work to fill out this idea, and do so of necessity. How can this be explained except

by the admission that they are exerted by him who apprehends or possesses the idea? But then the force exerted is a force ordered and exerted by him, and not a force ordered or exerted by the thing which is recipient of it.

Among these forces are forces of attraction, gravitation, affinity, life, and such like.

Now, observe that these are not entities, but are energizings of an entity. They are not even essential qualities of a created entity. Life is an essential quality of God which pervades all his attributes, but none of the modes of force appearing in matter are entities or qualities of the things in which they exist. They are simply modes of energizing in them. Gravitation is not an entity, and not an essential quality of the atoms. The atom might exist and be a perfect atom without it; and the same is true of all its qualities, except extension, figure, and impenetrability. These exist by virtue of its existence, but it has no existence except as it is caused, and its cause is the cause of these qualities. When the atom exhibits force of any kind it only manifests the fact that an agent is working in it, not that itself is an agent. The force is not something which belongs to it, but the agent who works in it and necessities changes of its state or relation; the change is not something which it causes, but something which is caused by the agent operating it or working in it; and the law regulating the action and changes is shown to be an infinitely perfect law by the effect produced, showing that the agent who works is not a dumb atom, but a being of infinite power and wisdom.

All forces modes of divine energizing.

Life is one of those modes of force by which so many things are effected. It is often represented in such terms as to imply that it is a real entity, with large endowments which create the organic universe. Not a few writers do not simply imply this, but formally propound it.

On the contrary, we affirm that life, as it is revealed in things, is no more an entity than gravitation is, and in no respect differs from it, except in mode. One as much as the other is simply a mode of divine energizing to produce or cause certain things to exist and act in certain ways. Gravitation is energy exerted in atoms, by which they are operated to collocate and form masses instead of remaining apart. The energy is exerted according to a fixed law, namely, it is as the mass and inversely as the square of distance. It is one of the modes of energy for making worlds.

Life is, in the same way, a mode of energy for producing a certain kind of existence called organic. The energy is exerted in an atom, which is transformed by it and becomes a germ, namely, a center of peculiar force exerted in it to reach forth and transmute contiguous substances and form them into a curious structure to which we give the name of organism or organic arrangement. The energy which seizes upon the atom and transforms it into a germ acts in the transformed germ to the production of the structure. The structure is said to be alive by the mode of force which causes it to exist—or its life is that mode of force—a divine energizing. The germ of organic structure is material, that is, is simply a minute piece of matter. Divine energy working in it transforms it into a center in which it operates to build a given structure—the unique force is simply a mode of energizing.

Life a mode of energy.

Thus far we have contemplated the universe in its purely material aspects, as it is constructed out of material elements. Before advancing to the study of other aspects there are some points which demand further elucidation. Among these is a more careful consideration of the question of the reality of the material universe, or, rather, of what the reality is.

We have assumed the reality of a material substance as a

created something whose essential attributes are solidity and extension. It is doubtful if we can assign to it any other.

To our spontaneous thinking it is crass and massive. This arises from the fact that we behold it in immense collocations. We have found that in fact it is an inconceivably minute substance; so minute as to be invisible and impalpable in its atomic state, which is its primary condition. Of this there is clear and abundant proof.

This gives rise to the doubt with many whether there is in fact any reality of substance, or whether the so-called material universe may not after all be simply an idea produced in us by divine energizing. Many of the most astute minds declare themselves forced to this conclusion. The only reality, to their thinking, is spirit, created and uncreated, with inhering attributes of intelligence and energy.

It is too rarefied a speculation for most minds, but this is not determinative of the question.

We hold to the reality of the atom, and through collocation to the immensity of the physical universe. And this gives rise to the question whether all is not resolvable into the physical; whether, in fact, there is any other substance; whether all the phenomena may not be accounted for by the atom; and especially whether, allowing the atom to be a created something by an eternal and infinite spirit, all phenomena may not be accounted for by the energizing which produces the atom, and by energizing in it so that it accounts for all the phenomena of consciousness—intellect, sensibility, and will—without the necessity of another kind of substance or entity.

Reality of the atom.

There is with many minds a strong tendency to monism in one direction or the other, either to resolve all into spirit and possibly thus to fall into pantheism or idealism, or to resolve all into matter and force and so renounce theism and all forms of religious faith.

If matter can account for all phenomena, then God vanishes as a myth, and man is resolved into a clod. If, on the other hand, all phenomena can be explained as mere modes of divine energizing the material universe disappears entirely.

We find it impossible to accept either theory. To our thinking the material universe must stand as now, and cannot by fair reasoning be brushed away or reduced to a mere idea or mode of spiritual energy; and on the other hand spirit must still be held to be antecedent to and actual creator of matter, and, as energizing in it, the cause of all its orderly processes and phenomena.

It is asked, If matter is absolutely forceless, or does nothing itself, of what use is it to the problem? Why insist on retaining it if it serves no purpose—explains nothing? Matter forceless.

To this we answer in two parts: First, we insist on retaining it because we see no way to get rid of it. It stubbornly refuses to vanish at our bidding. Indisputable phenomena demand its retention and refuse to be explained without it. This is reason enough.

Second, that matter is forceless, that is, does nothing itself and can do nothing in the way of accounting for what we behold—is forceless as cause of any change that appears in it—does not prove that it is of no use in solving the problem of the universe. That very fact makes it of the greatest possible service. Its forcelessness establishes the most fundamental truth in the entire problem, namely, that there is power outside of and above it. It forces conviction on us of its reality simply by its presence—it compels us to acknowledge its existence. The evidence is clear that it is a made thing, and that it cannot account for its own existence or for the changes through which it has passed and is passing; that, therefore, it had a maker and is a thing passive in his hands. It *needs* God. Its very helplessness and absolute forcelessness show an infinitely

powerful agent as its cause. If it were a force itself it would obscure the proof of such a being—it would justify atheism. God made it and operates it to furnish the evidence to us of 'his eternal power and Godhead.' In it we see Him who is otherwise invisible. If it had power itself how should we know him as a maker, and in what would we be able to find any proof of anything but matter itself? Forceless matter proclaims an omnipotent God.

But in the same way that it demonstrates the existence of God it proves that man is a child of God and in nature a spirit like his father.

How does this appear? The question whether man is a spirit turns upon the question whether man's material body can explain what man is and does. Man evinces force of varied kinds. Is this force explicable by physical components of his body?

It is not given to us to know what matter in the hands of an omnipotent God can be made to do. If it can be made so that each atom attracts every other atom in the universe across almost limitless spaces, or so that it has the fleetness of lightning or more yet of light, or so that one atom has affinity for another and antagonism to yet another, or so that it may become gaseous or fluid or solid, or so that it can transmute inorganic atoms into organic forms and living tissue, or so that it can enter into compounds and turn out systems of worlds, why may it not be so made as to think and feel and be self-conscious, and so as to indite and write philosophies and do all that has been done in the man-made and God-made universe? Why need we suppose anything else but matter?

To all this and similar questionings the answer is plain. Whatever matter may be made to do by divine energy it is not matter that does it, but the divine energy which necessitates it.

Self-consciousness in all forms of intellection, feeling, willing, is a mode of the activity of the subject itself and not of another. In order to these we must find a subject of whom such activities can be predicated as of its own powers. Matter is not such a subject. It may be impelled by impact of a will so as to run through the whole gamut of possible changes and so that each change seems to be a self-evolution, but it will simply be another acting on or in it. Left to itself it will be impotent to change, much more to any change implying purpose and intelligence.

The better answer yet is, it is not a question of the power of God, whether he could cause some matter to be self-conscious and to answer in every respect to what we ascribe to another kind of being, but it is rather this: How are we rationally to account for two totally different classes of phenomena which never appear in the same subject? Matter invariably exhibits one class and never is known to exhibit the other, and the reverse is true of spirit. On whatprinciple can we be asked to believe that either one or the other subject is sufficient to account for all the phenomena?

In organic forms the second stage of the great creative drama is reached. There is logic in the order. The new reflects a feeble ray—a glimmer on the mystery of the old. We are not able to discern that the old stands in any causal relation to the new; indeed, we distinctly discern that it does not. The new is not a development or evolution or even incidental or accidental outcome of the old, but in the old we unmistakably find many conditions of and intended preparations for the new. The old was made for and was prophetic of the new, but in no sense cause of it. The maker of the first is also unmistakably maker of the second, and manifestly made the first for

the second. Not simply the matter of which organisms are built, but the entire circle of economies in the whole inorganic realm are discovered to be necessary antecedents and indispensable conditions of the organic, and not only find their meaning in the organic but are meaningless without it. The order thus shows not simply relation but profound purpose—a great scheme, reaching through ages, the first rung of which contemplated the last and each intermediate, but no part of which is causal of that which follows. One is builder of all the parts.

Organic forms.

We know nothing of organic existence in other parts of the universe. There is great probability that it is a fact of all completed world systems. There indeed seems to be no other reasons for worlds. The varieties in other world systems may be extremely diverse from those found in our system. On earth there are two differentiable orders of organic existence, the vegetal and animal. They are not only different, but they are *radically* different—the one differing totally from the other in every respect of form and function and mode of production. This is a most important fact.

As between the inorganic and the organic there is logical order but no causal relation, but one serving as condition of the other, so the same is true between the two orders of organic existence. The vegetal must precede and condition the animal, but is impotent to account for it either as a development or evolution or accidental outcome. The lower antedates the higher and is indispensable to it and has no meaning without it, but makes no approach to an explanation of it. When the higher is introduced we discover why it was that the lower was previously made, but fail to find any causal connection or relation between the two. The former might have existed continuously and interminably without the latter; but the

latter requires the former, not for its existence alone, but for its continuance also. A fiat might produce it, as indeed it certainly did, but its nutrimentation and growth were made to depend on the tissues of the former.

Here is one fundamental differentiation between the two orders. The vegetable, like the animal, could only come into existence by fiat. The inorganic had no power to produce it; the dead cannot originate the living. But when vegetal life was created it was such that it could extract from the inorganic and unliving substance in which it was set the ingredients which made its tissues and contributed to its growth. To this end it was rooted in the soil and its peculiar constitution given it.

Difference between the two organic orders.

Its existence is conditioned but not caused by inorganic environments—chemical, electrical, thermal forces—light, heat, atmosphere, moisture, soil, and other necessary furnishings.

Organisms of both kinds have their laws and limitations, and are alike fragile and perishing, existing for a brief period, during which they propagate their kind, each in its own way and never varying the type, then lapse into death, relegating the elements out of which they were composed into their primitive inorganic condition. No exception has ever been known to this law.

The vegetable variety, after the creation of the germ, grows from a seed or germ cast forth by it and lodged in the inorganic earth, which, by a chemistry of its own, or rather energy to which we give the name chemistry, builds its living tissues directly from the inorganic substances in which it is posited, and, where the proper conditions exist, robes the barren earth in garments of verdure and beauty, flowering and fruiting a hundred and a thousand fold, without which the earth and

the universe would be an arid and lifeless desert. But the seed is not product of the plant as cause, but is product of divine energizing to that end. Thus God is cause both of the original germ and of that which grows from it.

The present order is that the plant of every kind grows from a seed or its equivalent and never without it, and that the seed or germ or spore or rootlet never exists without the plant which casts it, and neither seed nor plant ever departs from its type—the seed to grow some other plant or the plant to produce some other seed. But this could not have been so at the beginning. Either the earth must have at first been filled with seeds without plants to produce them or plants without seeds from which to grow, or neither ever could have been; but this renders a direct divine energizing absolutely necessary at the inception. The earth by fiat was first filled with germs, and these by the same fiat grew into self-propagating plants, shrubs, trees, etc., under strict and impassable laws and limitations. It is impossible in any other way to account for the universe of vegetal wonders.

There is no reason to suppose that sensitivity is a quality of vegetable life. In all its varieties it is totally void of all signs of anything resembling sensation or organs of sensation. There are semblances, as in the sensitive plant. Apart from the purposes it serves vegetable life reveals nothing of its cause that is not revealed by the inorganic universe, unless it may be a more delicate artistic sense. One cannot but feel that, in the creation of the flora of the earth and other living forms, there is evinced a sense of the beautiful. But as for the meaning of inorganic masses and the laws which pervade them we had to wait for vast ages to see how they serve the purposes of vegetable life, so here again, for deeper insight

into the purposes of the Creator, we must wait for another chapter of the drama to find the meaning of this lowest basement of the temple of life. We cannot go more minutely into the examination of these primary forms of organic existence. The student who may desire to pursue the subject further must go with some of the great biological and botanical masters and study the laws and habitudes of each species, from the minute microscopic plant to the great giants of the Calaveras forest.

The great fact discovered in the vegetable realm is that it does not exist for itself; that, in fact, it is part of a system—not an end, but at first a prophecy, and, when fulfilled, a ministry There is a fact, however, which it is well to notice, that the order was from the first progressive as to type; and another fact, that a condition of atmosphere for long ages continued in which animal types of life could not possibly have existed, but which was favorable to exuberance of vegetation. The air was loaded with carbon, which was afterward to appear in immense coal measures, the purpose of which is now perfectly understood. If the evolutionist should insist that this first organific form, called insensate or vegetable life, is the same in all vegetable existence, so that all forms come by developing stages, he is utterly unable to furnish the proof; but if he could it would not dispense with creative agency, but only deduce a method, and, so far as theism is concerned, would in no way damage it, but possibly rather improve it.

Passing now from the vegetable to the animal, we enter a new chapter of wonders. (See *Cosmic Theories*, pages 296–298.) The material of the animal organism, like that of the vegetable, is of the common substance of the earth, but, unlike the vegetable, it cannot transmute inorganic substance into its tissue. The food on which it lives and from which it builds

The animal order.

its organism must first have been elaborated in the alembic of life—animal or vegetable. It thus shows itself to be a higher type of life. There is no exception to the law. Animal tissue can only be produced by transmutation of substance once living or elaborated by a living organism. When no such prepared food is within its reach, after a brief period the vital force is expended and the organism wastes and perishes.

Were the universe denuded of vegetation all organic existence would disappear, and never under existing laws could reappear—air and earth and sea must forever remain a dead and meaningless mass of mere matter.

The variety of animal organisms is even greater than that of vegetable, ranging from microscopic animalcules, thousands of which sport their brief life in a single drop of water, to the mighty monarchs of sea and air and forest, whose lives carry up to centuries. Geology furnishes abundant proof that for unnumbered ages before the human epoch these forms of life have flourished on the earth, many ancient varieties disappearing and new types taking their places.

In the animal we reach the realm of sentient existence. A new and higher class of phenomena appears. The new order not only lives and grows, but it thrills with feeling and sensation. As in the vegetable organic we find ourselves compelled to admit an extra energizing cause and not a development from the inorganic, though conditioned by it, so here again, in the animal organic, we are under the same necessity. It is impossible to deduce the animal from the vegetable. It is a new and differentiable type. It has new qualities and ends which cannot arise from anything previously existing. The former furnishes no clew to the latter. If the developmentist should contend that from one sensate life all sensate life emanates by

evolution, we only reply now he does so on mere volition without proof. What we assert is that the new subject must have had a creator. That suffices all the demands of theism. We have entered a semimental, semimoral, semiconscious realm. The new creature has appetites and passions and lusts and affections, the gratification of which ministers delight and pleasure—a type of good. The old long azoic universe of the primitive fire mist and then of revolving worlds, where played mighty formative forces and still later the universe of insensate vegetable life, now thrills with ecstasy of life and song.

The new is built on the old and in part out of it but not by it. It is not simply a modification or advance; it is a new order, derivative from nothing which existed in the earlier economies, but subordinating them and demonstrating that they existed not for themselves but for a higher and nobler economy yet to be introduced. The same creative agent is seen throughout to be working to an end not yet reached. Each former state is preserved unchanged. The new does not abolish the old or even modify it, but uses it; even the types are fixed. There is no proof of the evolution of one species into another. Previously exerted forces always continue to do the work assigned them, but they do not become creators or transcend their function. He that commenced the work carries it forward through each successive stage by direct agency when additions are to be made. There is no journeyman work in the whole universe. No created thing sets up a new line of business on its own account. Every force is a slave which does simply what it was exerted to do, and is impotent to do anything else. There are no free causes in the field apart from the proprietor himself. As in the older, so it is in the newer and higher form of existence.

The animal sentient life or principle has conferred powers to act according to its nature, but among these are no creative

powers. It cannot in any measure transcend its determined function, or vary a single line from its fixed law. It seems to possess a semivolitional power rising above the mere automatism which reigns in previous economies, but its limits are stringent and narrow, while a great advance on the lower form of mere vegetable existence. In its creation a new facet of the creative factor is clearly manifested.

In the animal organic we come to a realm of exceeding obscurity. It is evidently a higher type of existence. Something is added to the inorganic, and also to the merely vegetable organic. It is not simply a difference of structural arrangement and type. A radically different creature appears. It is impossible to doubt that it is something different in kind. There is manifestly a creature which rises in grade above mere refinement of matter, and also above mere vitalization of tissue and structural arrangement and automatic action. We have a new kind of substance or essence—a sentient something. We find it impossible to doubt that it is a low grade of spiritualized existence, but as we know nothing of the possibilities of matter in the hands of creative agency, it is impossible to our unaided intelligence to affirm with certainty. Revelation reinforces reason in its ascription of a kind of spirit to all animal existence. Whatever it is, it varies in ratios and kinds of capabilities, but has permanent and rigid limits and qualities. It is dowered with capacities of feeling. It has preferences, passions, a degree of reason, social instincts, memory, language, and signs of affection; in some orders is improvable within limited margins. It is the outer court of a higher realm of existence. It lacks self-consciousness (probably in any degree), and improvable reason, and all the higher faculties of intelligence, and a proper ethical nature, and cannot be raised to the conditions of personal responsible existence or any free

agency of its own. It has no power of self-improvement or improvement of its state and surroundings so as to become different from what it is. There are no signs in it either in its natural or most improved condition of adaptation to anything beyond a mere earthly life—the life it lives in the organism which perishes. Of another and higher kind of life it can have no idea and for it no aspiration. The conceptual faculty—the faculty of forming ideas, of understanding what it beholds or experiences—the faculty of knowledge proper, of reflection, introspection, of understanding cause and relation—and everything which enters into personal being are wholly wanting so far as we can perceive. Whatever this mysterious being is, it is evidently created for the earth and runs the whole gamut of its existence in the brief time it lives on the earth, in some cases limited to a day, in some carried up to a hundred years. If more than a refinement of vitalized material tissue—and we think it is more—it can be but a low type of spiritualized being, mainly automatic, always below personality, and incapable of improvement to that state, and having no wants or aspirations which imply anything beyond what are fully satisfied in its brief time life.

As in the inorganic, and in the insensate organic, we find a mode of divine energizing to bring them to their ultimate condition, so here we find a mode of divine energizing required to create this new palace of life—the organism for a sentient inhabitant, and also the inhabitant itself. The organism itself is God-built, both in the first and all succeeding instances; though in the latter instance it is build mediately and not immediately. The creature which is posited in the organism is created by divine power. The organic arrangement is for it, and it also is for the organism. The organism exists under such laws, and is of such kind that it would immediately perish with-

out the creature which dwells in it; and when the creature has taken care of it and used it for the end for which it was created, the creature itself perishes with it, there being no other reason for its continued existence.

We realize that we are venturing here upon a new and unexplored ground, which to many, perhaps all, will seem speculative and fanciful, and we may miss our way. The effort is tentative. We therefore ask attention to some reasons and explanations. In the vegetable organic, the energy called life in it, as a simple mode of divine action, accounts for all the phenomena. There is no need of supposing anything further. The structure is built by a force which transmutes and incorporates contiguous inorganic substances. The structure built has no feeling—is simply a built thing—purely material. It evinces nothing but a constructive agent, and common material curiously wrought together, which in time is necessitated to propagate similar structures according to a fixed law. This is all that appears, and entire it is accounted for—that is, all the phenomena are accounted for—by assuming a being of intelligence exerting force to the end reached.

When we come to the sentient or animal organic we reach entirely different kinds of phenomena, which cannot be so explained.

So far as the mere material structure is concerned the difference is not great. The material in both cases is precisely the same—not a minute difference. There is difference of arrangement and adjustment and functions merely. The organism in the second case is more complex, more wonderful. A divine cause is absolutely needed to account for the existence of the organism simply as a structure. It does not build itself. The forces exerted in its construction are not blind forces. But after it is built it immediately emerges upon a line of conditions,

if we might say experiences, which did not appear in the case of its predecessors in the vegetable realm, and an entirely new set of phenomena appear, which seem to demand something more than the organism. A new kind of creature emerges that is more than an organism, and which cannot be noted as a mere mode of force. The organism was fairly accounted for as product of divine energizing. This creature is a new creation, which the energizing that built the organism, and which the organism itself, does not account for. The former builder now creates a new kind of being. The necessities of the organism demand it. It will immediately perish without it. This new being has new qualities, which are not deducible from the materials found in the organism itself. It must be a new entity or kind of substance. An entity that can feel, and act from impulse of feeling, must possess a new kind of endowment, must be in a degree rational and capable of self-action. This has never been reached in any preceding creation of inorganic or merely organic things, and is impossible to be deduced from them or any mode of force expressed in them.

The body made of matter does not feel, has no impulses or desires or instincts. Its life is a mode of exerted energy in it; but a creature is now placed within it, so as to be able to use and direct its members, to ends of its own preservation. This indwelling creature has feelings, impulses, desires, longings, is susceptible of pain and pleasure, and has a kind of power which responds to these excitants, and directs the body to the things which are necessary to its support and to the propagation of its kind. The organism, and the indwelling creature thus endowed, make the animal or sentient universe. It is thus seen to be more than a mere structure of atomic substance and more than a force which builds such a structure. It is a new and higher order of created being.

Some imagine that the creature after its creation becomes the

builder of its own organism. There is no possible ground for such a supposition. The offspring as much as the parents are divinely energized through the parents. To suppose the living animal to produce its offspring other than instrumentally would require that it be able of itself to scheme the organism, and that it has power in itself to construct its parts, and also to produce creatures like itself. This would make it a God. Throughout it is but an instrument, a mere duct of divine energy.

Sensitivity, that is, feeling in any form, thought, impulse, desire, volition, even in the lowest degree, cannot be ascribed to matter. Matter may be refined and arranged into the most delicate and beautiful forms, but it has no power even in these respects over itself. It is powerless to any change of state even, or relation. What it seems to do is but effect produced in it under strict law. The force, whatever it is, which always acts under law or according to law, must be exerted by a being who regulates his action by law, that is, a being who knows the law and governs himself accordingly. But no one can imagine that the atomic * components of matter answer this description.

That the animal is not a mere compound of matter is manifest in the fact that it evinces feeling, thought, desires, will, in varying degrees. This can scarcely be doubted. But then the animal is something more than mere composition of matter or endowments of matter.

The body as a collocation and arrangement of matter merely, which is evidently all that it is, might be evolved as a stone is, or as a tree by the force of a building agent, and using it the constructive agent might evolve other similar or dissimilar bodies from it. That would indicate simply modes of his working. It is not like the stone, or tree even, which find the elements of their construction and contrivance in direct modes of

* See Winchell's *Evolution*, pp. 36, 37.

force in them. It must have nutrimentation or its tissue immediately perishes. And its supplies are not furnished by the operation of mere forces in it or contiguous to it. It does not know its own needs or how to provide for them. It does not even feel the wants which are urgent for its continued existence. Its fate would be immediate death left to itself. Moreover, alone, its preservation would have no significance.

Now, to provide for this helpless thing, its maker places in it another kind of creature, which is so intimately related to it as to apprehend its needs and know how to provide for them, to feel its wants and know how to avoid its dangers. These two are found to be for each other; and except as they serve each other, and other higher ends to another order of beings, have no reason for their existence. They are in no sense cause. There is one creator of each; but one creator makes them both. They are different in essence, in substance, and degrees of worthiness. Sensate existence ranges higher in the scale of existence than insensate. The animal is more than the clod, and more than the mere vegetable. The animal inhabitant of the body derives sensations through the body which minister to its delight. It has thus an enjoyable existence—an ecstasy of life.

In considering the organic universe we should keep in mind that we have found evidence that the date of its advent must be fixed not less than perhaps scores of millions of years subsequent to the primary creation of matter, and yet later to the time of the solidification of the earth's crust, during which long period the conditions of life had not been reached.

The Laurentian system of strata laid down upon the original floor of the refrigerated crust is estimated at not less than forty thousand feet thick. It bears evidence of a highly heated condition of the surface throughout the entire period of its sedimentation, and of a molten under crust at no great

depth. This is an undisputed fact. If life appeared at all in that deposit, it was not until near its close, and that even is doubted. It was long classed as azoic, and the recent assumption of some careful and able geologists that a form of life did appear in it admits that it was of a type so rudimental as to leave it an unsettled question, and in any event only toward its close.

The Paleozoic era marks, if not the absolute dawn of life, certainly its earliest clearly defined types. This group is given at not less than forty thousand feet thick. In its lowest strata, at the basement, life appears in considerable variety and great profusion, but in the animal only in invertebrate types. Molluscans continued to be the only order of life for a long period. For a more particular description of its varieties, see works on the science.

We are at the beginning of the life system, or of organic existence. It marks the introduction of a hitherto not manifested force—a new factor. The quality and character of the new agent, or rather new mode of agency, now for the first time appearing in these humble types, must be judged not alone by these products, but by its unfoldings through all succeeding periods; but, however judged, it must be borne in mind that it was a form of agency hitherto not expressed.

That it was the same agent who for indeterminable time had been employed building the world itself cannot be doubted. The former part of the work had been preparatory and conditioning to this new and advanced order. We say advanced order, for between the inorganic, in whatever of magnificence its scale, and the lowest and humblest type of the organic there is an infinite advance in kind, and new qualities in the agency displayed. Everything betokens advance and purpose. Following these lower forms, but at long distance, though of the same era, as the rock record shows, appeared higher types both of vege-

table and animal varieties—marine and land—varieties of fish and carboniferous plants.

The period, as shown in the former section of this work, was one which extended through millions of years, and which abounded all through with almost infinite variety of a low type of life, as seen in the fossiliferous contents of the deposits, but it shows no sign of advance above the molluscan and fish types. But in this there was marked growth and advance. Were it possible to know the atmospheric and chemical conditions better than at this distance of time is possible, we might perhaps understand better than we now do why the age of inferior types was so long drawn out. We are able, however, to assign one most important reason, a reason which foreshadows the great plan which was yet in its beginning. It was the age of preparation for man, the coming king ; the age when the great coal fields which he would need were being corded in the caverns of the globe, and during which the great oil reservoirs were being prepared for his use. To secure these ends time was a necessary integer—and vast ages of time. The animal life during the period was such as the conditions permitted, and though we may not be able to see a reason for their existence, we find that in fact they did exist, and served remote ends, proving forethought and plan, and possibly indispensable means to plans yet unrealized.

Of this era Le Conte says : "Perhaps it is not inappropriate to group some of the most important facts in the very brief outline-picture of Paleozoic times. We must imagine, then, *wide* seas and *low* continents of *small extent ;* a hot, moist, still air, loaded with carbonic acid, stifling and unsuited for the life of warm-blooded animals. If an observer had walked along those early beaches he would have found cast up, in great numbers, the shells of brachiopods ; clinging to the rocks and hiding away among their hollows, instead of sea urchins and

starfishes and crabs, he would have found crinoids and trilobites. In open seas he would have found as rulers, instead of whales and sharks and teleosts and cuttlefish, huge cuirassed sauroids and the straight-chambered orthoceras. Turning to the land he would have seen at first only desolation; for (in the earlier deposits) there were no land plants until the Devonian (above the Silurian deposits), and almost no land animals until the Coal. During the Coal there were extensive marshes, overgrown with great trees of Sagillaria, Lepidodendra, and Calamites, with dense undergrowth of ferns, inhabited by insects and amphibians; no umbrageous trees, no fragrant flowers or luscious fruits, no birds, no mammals. These 'dim watery woodlands' are flowerless, fruitless, songless, voiceless, except the occasional chirp of the grasshopper. If the observer were a naturalist, he would notice also a complete absence of modern types of plants and animals; it would be like another world."* This was the world of life, with scarce a representative to-day, for an era extending through millions of years. It was made for its time, and disappeared with its environments; but its uses were for a far distant age and time.

When the Paleozoic era had culminated a period of oscillation and revolution whelming existing species supervened, and a new era dawned, the Mesozoic or reptilian age.

The general characteristics of this period are the culmination of a class of reptiles among animals and cycads among plants, and the first appearance of teleosts (common osseous fishes), birds, mammals among animals, and of palms and dicotyls among plants.

We cannot be more particular; the reader must seek information from treatises on geology. What we wish to call attention to is the continuous advance in the types of life in both

* Page 400. For fuller description let the reader refer to this author on the Paleozoic era.

realms and the slow upward movement across the bosom of immeasurable ages, and yet an increasingly rapid movement toward the final epoch, the epoch for which all other epochs were made.

The Cenozoic era, which followed, was marked by the same characteristics of advance in types, and by a less though vast consumption of time. Mammalia came to fullness, and distinguishes this period.

We have now reached the dawn of the final era, the Quaternary, and more recent—the age of life as it now exists throughout the world; with the exception of some types which have disappeared in recent times by the destructive forces of the glacial age immediately preceding.

Let the reader remember that this brief outline of the history of life is not made out of uncertain traditions, but is a faithful record of facts and events made at the time and incorruptibly preserved in the imperishable archives of the long-buried strata of the earth itself, in which not a fabulous or exaggerated description is transmitted, but the very forms themselves are enshrined. It is as though we stood at a point of time and the great procession of terrestrial life passed before us, the mighty procession beginning with sporule, then the most ancient and primitive type, and in its order each subsequent species of fauna and flora, on down or up the ages following, the head of the strange orders having a date millions of years back, and each new group bearing a banner denoting the time when it lived and flourished, until he finds himself among the forms which rise and prevail at the present moment—the long line of molluscans with the date of its dawn and close; following it the strange denizens of sea and forest which stretched from Siluria, on through Carbonifera, while the coal fields were being built, to Devonia and its close; then

the Miocene varieties of great reptiles and monstrous half-bird and half-simian tribes, and then the grotesque and frightful mammals of the tertiary epoch—each age increasing in type and form until he finds himself beholding the familiar types of sea and sky and forest, of farm and grove and home, which are living to-day.

What a procession! Were we possessed of a wand of magic power to restore them as they were, to rifle the rocky sepulchers of their treasures, so that they should live and move, as they once lived and moved, through all the vast ages—live and move in exact order as they were, every inch of the globe's crust would turn to life and the seas and atmosphere would be crowded with inhabitants. Ten miles deep would be pulverized to restore perished forms.

Death and life have run *pari passu* through all the ages. Each order and type was made for its time, and each individual for its lot, and the besom for its destruction was concreated with it. Why shall we delude ourselves with fancies when facts confront us? The maker of life is also the maker of death.

There is yet one other fact of the organic universe which the needs of other problems which confront us demand should be noted.

It is not only a fact that life and death have thus prevailed over millions of years in exact ratios and parallels, but this also is a fact, that life has always been a brigand, a marauder, a cunning assassin, a remorseless murderer. It comes armed and panoplied for warfare and destruction with fang and claw and ravenous appetite for prey. Power and mechanism were given to the eye and nostril, and fleetness to wing and fin and foot for carrying on warfare. All the ages have been a perpetual battle. The roar and scream of chase and raven have filled the air of all climes and times. The earth has been an aceldama

since it became the abode of life. It is in vain to try to conceal a fact which is written on every page of its history.

The retrospect adown the vista of long-drawn eons seeks in vain for an age of peace either in the organic or inorganic universe. In the inorganic primeval fires and volcanic torches light the way with flame, and earthquakes rending and creating mountains, and floods inundating and whelming continents, and frozen zones sending ice fleets plow and desolate hemispheres at intervals along the entire course, while poisonous and life-extinguishing vapors surcharge the atmosphere and exude from the earth itself; in the other from dawn in the long ago to sunset of to-day death and rapine skirt the way, decay and ruin are alone universal. Nature was so made from base to pinnacle.

Along with the ravages there have been growth and progress; beauty and deformity have marched hand in hand, ecstasy has walked hand in hand with pain, life has gained by death. The facts are as they are, and He who orders them will need no apologist, the outcome of the history will fully explain all antecedent chapters, however full of mystery, and all that has been done will be seen to have been well and wisely done.

There is a developing order. The proof is clear and full upon that point. According to our thought the facts show this, that first there was the idea, or the ideator with the idea, and they do not show that primarily there was any other existence but the Being who possessed the idea of as yet nonexisting things. The subsequent existence of things proclaims the necessary preexistence of the cause, and that in him existed the idea of things nonexistent and the power to actualize them or to give them existence. To this conclusion we are shut up.

This gives us to start with an eternal Being who possessed

the idea of things nonexistent, with power to produce them. The universe is as a fact the product of the preexisting agent. Of that great Being and the attributes implicated in the product a subsequent treatise will discourse.

Here and now we postulate as a necessary fact such a being, and the idea as antecedent to the product.

Of the product we have already endeavored to give some of the well-ascertained facts, specifically facts as to its magnitude in space, together with its established economies and the time order of its unfolding from its beginning to the present.

We have affirmed the immanence of the preexisting agent in the thing made, first as creator of actual elemental substances, and second as continuous acting force, causational of all the modifications through which it has passed, is passing, and yet will pass—the so-called forces ascribed to it being only modes of his own energizing in the created elements, to the end of making real things previously existing only in idea. Thus, while the modifying force seems to emanate from the atom itself, it really emanates from divine energizing in it, using it to the end of certain collocations for which it was created—the inorganic universe.

Passing from the inorganic to the organic, we encounter a new set of facts and a new order or method. Do we come to a different agent? Not at all. We are still marching with the same builder who laid the foundation in the atom.

Let us remind ourselves of some facts which enter into the new problem:

First fact: When the organic universe was commenced, no difference how, the inorganic universe had already existed for vast ages, and had passed, by a developing process, from the atom through great changes to its present condition—that of an orderly system of immense proportions. Of this the proof is

clear and absolute. We say nothing now of the agency by which, but cite only the indisputable fact.

Second fact: A condition of the inorganic system had somehow come to pass without which the organic universe could not possibly exist, but in which all the requisites thereto were fully attained at the end of a long process.

Third fact: The organic now exists in infinite variety of strange and immensely complex structures, which none of the forces or modes of agency operative in the inorganic can account for.

Fourth fact: The elements, or substances out of which the organic is built, are precisely the same elements or substances out of which the inorganic is built.

Fifth fact: The organic differs from the inorganic in several respects, not of substance, but of structure and quality.

Sixth fact: The organic is not an aggregation or collocation of substances merely by the attraction of atoms—gravitation—or by chemical affinities, or by cohesive force, or by compounding substances, or by any of the forces which were and are discoverable in the inorganic universe. Nothing is found there which intimates even a tendency to produce organisms as structures, or the unique qualities of inwrought tissues, or life phenomena of any kind. The inorganic furnishes no hint of it—no tendency to it.

The only possible explanation of it is that it is a divine creation—the product of a personal cause.

Confining ourselves for the present to the simply organic—vegetable and animal—realm of life, and not including the higher personal realm, let us see if we can give some account of it.

Take first the vegetable organic. How wondrous in beauty and usefulness it is; how infinite its variety—microscopic,

great of stature, delicate that a zephyr or mildest ray blasts it, robust that it wrestles with a cyclone, flourishing beneath the sea, robing the mountain and the plain, rich with flavors and perfumes essential to all life, the feast spread for bird and beast and fish and insect, with pattern and form and color for artist and angel, springing amid polar ice and snows and growing to utmost luxuriance on equatorial plains, medicinal, nutritious, life-supporting, loaded with deadly poison, all useful to some purposes—who can explain their genesis and multitude and variety over all climes, but in a mysterious energy outside the dumb elements of inorganic substances?

Let the reader keep in mind that it is no part of the object of this treatise to attempt a theodicy, or even to philosophize of cause or the nature of the agency at work, but simply to submit the facts of the universe in their order and method. Their bearings will be matter of future discussion.

What we claim now is simply the existence of the facts narrated and in the order named. These are held to be scientifically established.

The general facts are as shown: (*a*) the almost infinite extent of the universe system in space and time; (*b*) that the organic appears after an interval of millions of years subsequent to the dawn of the inorganic; (*c*) an order of advancing grades and kinds; and (*d*) that forces have been found at work corporate with the organic and inorganic, and running parallel with the organic, that have been destructive of all the individuals and orders after a brief period of existence.

It is proper, however, before passing to a further stage of our inquiry, to note some necessary implications from the facts already stated. Necessary implications are among the facts, and among these are the following:

1. Any fact which begins in time is a caused fact.

2. Anything caused implies at some stage of recession a somewhat that was not caused.

3. All the forces we have found in operation are forces exerted by some being at some time; and so there was a beginning to the exertion.

4. A universe evolved by forces must have back of it a being that evolved it.

5. The agent of the evolution must be different from the thing evolved.

6. When the product evinces intelligence the force exerted shows that it is exerted by an intelligent being.

Of the facts stated in the preceding pages as to the time and space measures of the universe, there is practically perfect agreement among all students who have given attention to the problems. Of the orderly progress and processes from the atom to the present condition of things, the evidence is almost the equivalent of absolute proof. There is no reason to doubt its substantial correctness. We may assume with perfect confidence that it accords with the facts.

The only dispute now is upon two points, namely, whence the forces operative, and how the series of facts stand related to each other; or, in other words, whether the facts are to be accounted for by a continuous divine energizing bringing them along in the observed order; or whether the original atoms account for them by either inherent forces eternally existing in them or by energy imparted to them when they were created.

That the former view is now generally accepted among representative scholars along the involved lines is certainly true; but that is not the matter of our present contention. We aim simply at the statement of facts.

When Mr. Spenser asserts, in the following of eminent German thinkers, the principle that the onward movement of

the universe is an unvarying and universal progress or development from the homogeneous to the heterogeneous, he asserts an unquestioned truth, but it is no new discovery. It is simply the old statement made by God himself, put in new terms; namely, that he began his work first by creating substances, or the elements of the inorganic heavens and earth, which in course of time he completed, or, more properly, so far advanced as to render them a theater for new and higher display of his plan and power, and then in a series of successive energizings fashioned the organic creation. Moses wrote the principle nearly four thousand years before man made the discovery.

The primary creative act is now admitted to be an absolute necessity of thought. The forces found in the elements or atoms were imparted by the creative act, or are simply continued modes of energizing. The catenated history of developing effects is simply a mode of passing from the homogeneous to the heterogeneous, or from simples to aggregates and compounds, and on from collocations to worlds; and the phenomena of motions, positions, and changes which are found to have unfolded through advancing ages, by or according to fixed and established laws.

The principle holds good as denoting progress from lower to higher orders up to man. When the attempt is made to deduce development of the higher from the lower, it breaks down for want of proof. The fact is not ascertained, and to assert it even as probable is in advance of warrantable conclusion.

But let us not lose sight of the sublime facts which are clearly made out. In them we see the marvelous worker no less than the marvelous work. We see what He has done, and dimly perceive, amid the obscurities which must forever hang around the subject, the method observed. The how remains shrouded in impenetrable mystery, but the facts shine with the clearness of

day. Of much that we do see we are at almost as much difficulty to understand the wherefore as the how; but where there are so many evidences of supreme wisdom, we may reasonably conclude that for every fact there was, and is, a good and wise reason; and for the method, in progress and outcome, the end will vindicate its Author.

Who can contemplate the amazing panorama of wonders which the universe presents, so inconceivably vast in time and space, so marvelous in its complexity, yet so harmonious in its parts, so involved and varied in its orders and economies, and yet so wrought into simplicity and unity of design, each individual atom ever under its own law and working its own ends, and yet all working to a common outcome, without awe of its great Author? Surely the power and wisdom displayed are infinite. But did the scheme stop with the inorganic merely, or even with the organic, how impossible it would be to find in all its wonderfulness a worthy end! Of what avail would be all its magnificence?

OF MAN.

MAN and man's history belong to the story of the universe and must serve as key to the problem.

Before we assign the reasons for separating man from the organic orders and assigning him a peculiar rank above the organic, we call special attention to the fact that in point of time he is acknowledged by all students of the problem to be the most recent fact of the universe. Whatever differences exist as to the exact date of his appearance, there is no dispute as to his claim to be the end of the series, or as to his distinct and superior grade. These are facts admitted by all. Even scientific evolutionists make man the end of the series up to date, and admit their inability to conceive another advance. His place is thus secured.

Christianity goes further and assigns to him a career and an order of developing life not fully reached during his existence on the earth, and assigns to that after and interminably continued existence the culmination of the creative plan and movement.

It is a possible conception that the higher organisms might be evolved from a lower type—that the principle of animal life, that is, the divine force it represents, might be a common principle from which the human body was evolved at the end of all other evolutions; but this would not account for the new creature man. Of such evolution of one organic type from another, and of all from a primitive rudimental type, there is not a particle of positive proof; but if it were clearly established it would still fall infinitely short of accounting for man. It would or might conceivably account for his body, but this is not the problem,

and makes no approach to its solution. But, as we have seen, even allowing the method of evolution in reaching the various types for the initiative, we are compelled to admit a creation of a new order and kind of existence to begin with.

The problem here is to account for man. To do this we must first determine what man is. We know that he is, and coarsely what he is, and about the time that he appeared, and that organically he is the last of a series. We do not absolutely of personal knowledge know that in this respect he is not an evolution, that is, in respect of his organism. But the deeper question as to what constitutes the essential man we must be at greater pains to answer. What, then, is this new and latest creature?

To this question we answer: man is a spirit, as to the essence or substance of his being; that is, as to substance he is immaterial, having none of the properties of the inorganic elements out of which worlds and organic creatures are composed, but differentiated from them by totally dissimilar qualities and attributes, excluding all which they possess, and which raise him into an order of existence similar to the Infinite himself, and which constitute him a child of God and not a mere thing. He is shrined in an organism composed like every other organism out of material elements, but different in structure from all other organic existences. He is not the organism. He is not developed from or by the organism. The organism is no part of him, but is simply the temporary home in which he begins his existence and by means of which he is initiated into his proper selfhood.

The organism in which he is shrined is similar in all essential respects to all other animal organisms, but different from them in grade and fashion for adaptation to his peculiar needs and uses, and is a direct provision for his use and service for a limited period of his existence, during which he is made dependent on it.

As, at first, the organism was created before he was made and posited in it, so the organism is propagated in order to the existence of every subsequent man who is brought into being.

The organism which is provided as the shrine or temporary home of man is first a mere physical structure partaking of the characteristics of all merely animal organisms, and participating in no degree in the essence or attributes of the inhabiting spirit. Its only peculiarities are found in the specialized forms and qualities which adapt it to *his* service. The life of the organism, whatever that may be, is not essentially different from that of any other animal organism. The organism and its animal soul dwelling in it are animal pure and simple, acquiring only the distinction that they are for the service of a nobler life which dwells in, but is not of, them. This marks the differentiation between man and all animal existence. Neither the physical structure nor the inhabiting living creature, which is for it, but not of it, is man, or any essential or permanent constituent of man. They sustain only a temporary relation to him when they perish.

That there is a spirit of man which is entirely and essentially distinct from the organism is only denied by a school of materialists, but it is generally supposed and affirmed that the organism is an essential part of him. Some assert a trichotomy —nearly all declare in favor of a duality.

In the former case it is insisted that man is a triplex unity, compounded of a physical body, which is simply a structural arrangement of matter, and a soul of animal characteristics, which animates it and is for its special life and service, and an immortal spirit of special and high intellectual and ethical endowments. These three constitute man—each essential to him.

In the latter case it is contended that man is a duality, compounded of the body as a living organism and the immortal soul with its endowments as above described. These two are essential components.

In both cases it is admitted that the immortal spirit is a distinct essence, having being of its own, and differentiable in every respect from the other constituent or constituents of the compound; but though thus differentiable it is not alone, or without the other or others, man.

On the other hand, it is our contention that the immortal spirit is man, and that the physical organism and the animal soul which are made with it and for it are both and alike but temporary adjuncts to him, serving an end and then disappearing forever. To have the body of a man we concede implies a man; and for this reason many, who look only at the exterior, think of the body as the man or of the man. We contend that it is neither man nor a component of man; but, on the contrary, is simply his habitat, which serves as his temporary dwelling place, and is in some way—many ways—instrumental to his use and service. To be still more explicit, we affirm that there is no part of its essence that is any part of his essence, and no part of its attributes or qualities that is any part of his attributes and qualities; that it is simply a transient accident of his existence, an external thing to which for a time and a purpose he sustains certain relations. Its life is not his life, and his life is not its life.

Of this body we affirm yet further that it is simply a compound of the inorganic elements vitalized, that it belongs to the common organic creation in essence and attribute, differing only in type from all other orders and individuals of the animal creation, and possibly in the mode of its origin. In essence it is identical with possibly higher refinement; in structure it is

superior and unique, for the ends of service to the spirit, for the habitation of which it is a prepared abode, and for the service of which it is a specially prepared instrument. It was fashioned for him, and he was created in adaptation to it, and with temporary dependence on its instrumental uses during the early stages of his existence.

Any difference of dignity and worthiness between it and any other organic existence is not in kind, but is simply in the higher uses it is appointed and structurally adapted to serve, as the dwelling place of a being superior to itself.

The animal soul inhabiting the body possesses the common instincts of all animal life, and was and is doomed to their common fate under the operation of laws common to it with them. They live and die and perish together. They have no more function. They were for the earth and run the gamut of their existence during the present life. Alike impersonal, they are alike irresponsible, and when they perish never appear again. They serve their full purpose as instrumental to the man's existence and use. And he is given possession of them in such degree as is necessary to the initiation of his responsible existence. Their proper use or abuse determines his character and affects his destiny. When they perish he lives on. They have reached their end. He has only begun his progress in life. All that is personal—his self-conscious being, in its perfect and unchangeable identity—passes out and on to a higher stage, or to meet a destiny wrought out while he was in his time life.

There is a true theory of evolution, but it is not that propounded by Mr. Spencer or his collaborator, Mr. Darwin, and the multitude of their less eminent disciples, who are fascinated with the catchword and hasten to retail at second-hand their unscientific conclusions. They have done good service in their

painstaking labors to ascertain facts, for which all students of nature owe them a debt of gratitude. So far they have shown themselves true scientists, but when they have attempted a philosophy, their theories evince haste and prove to be utterly abortive, not to employ harsher terms.

The fundamental fact underlying all theories is that the universe is a created something; there was a time when it did not exist—when nothing that is in it existed. The proof of this is irrefragable. To a creative cause, whatever of things, force, law, economy, or anything else, must be traced. Its unfolding development is simply an evolution of the divine idea and powers. The forces which play in it are shown to be simple modes of his working in order to the realization of his ideas. Nothing in it is a transformation of his essence, but so nothing in it has any existence apart from his power. It primarily existed in him as idea. It comes to objective reality by his power. The force which first produced its substance and then works modification and changes in it, through the whole gamut from world structures and economies on through all cosmic changes and organic types, are his power in action to these ends. It is impossible they should be anything else, since that which did not exist could not have any force or anything which it does not receive. And whatever is received is traceable to the giver and not original to the recipient.

That which acts from necessity is not itself actor; it acts only as acted upon. The force exhibited in action is a force exerted by the necessitating agent.

There is a close consecution of effects observable in the universe, in which one change seems to spring from an antecedent change, but in fact it is not so. The necessitation observable in the whole series points to the prime mover as the continuous mover. Where the series works to an idea the proof is that

the agent in each fraction of the series is working out his idea. One change in the series does not account for its successor, but each change can only be explained by the agent of the whole.

The evolution is not an evolution of something in the first member of the series, but is an evolution of power in the agent in order to an idea which he has and to which he desires to impart concrete objective existence. The closely catenated and consecutive energizings in each part are simply modes by which he evolves the entire chain, or, in other words, the universe is evolved by an intelligent agent in successive and fixed modes of energizing in a closely catenated series of things. The things account for nothing—are mere products. True, all forms in the series are transformations of some antecedent form but not by the things themselves. That things themselves do anything there is absolutely no proof. The agent himself is a free cause throughout the series of changes. The series is necessitated by him throughout by the constitution which he establishes and by the force of will which he exerts.

It is perfectly obvious that man, while a distinct order of existence, stands in close and intimate relations both to inorganic and organic realms—to the inorganic in two respects: (*a*) in being posited in a body made out of the common inorganic elements or substances; (*b*) in having an organism in fundamental respects resembling other animals; but it is no less obvious that he is fundamentally different. Related to each he can neither be identified with nor traced to either or both. He is more and other than an organism composed of inorganic elements, whether by development or an evolution through inferior types. He is differentiable from his organism not simply in form and origin, but also in kind and nature of substance. He is a new creation—not merely a more developed type from existing creatures, taking on new characteristics.

If it required a creative act to introduce the atom as base of the inorganic, and then again a direct energizing to introduce the vegetable organic as lowest basement of life built on the inorganic, and yet again to introduce the animal organic—the sensitive and instinctive realm of life throned in the merely organic in its lower form, but distinct from it—much more is creative agency required to introduce this highest form of terrestrial existence. To that end development, or any form of evolution, is impotent. We have an essentially new creature. As the inorganic was necessary condition precedent to the organic, so the organic was necessary condition to the superorganic in man, but impotent as cause.

The view here stated will find strong opposition. It is, in some respects, novel. But we hope to be able to show that it is true, and that, though novel, it is the logical sequent of long held and popularly admitted premises, and that it is supported by strong proof—the strongest possible.

Scientific and speculative developmentists and evolutionists reject it because it is out of harmony with their theories. All materialists reject it on the same ground. Popular theology will be disturbed by it because it will require some new construction of long regnant favorite notions. Dualists and trichotomists will rise up against it as out of harmony with their conclusions. Philosophical idealists will be offended because it gives reality to the body and accords it actual existence. Literalists and verbalists will hurl texts and creeds against it, and will scent heresy in it. None of these things alarm us. We have but one solicitude; that is, to get at the truth.

Our thesis, it will be perceived, does no dishonor to the body. It accords it a high grade of worthiness. It makes it a divine creation for a high and honorable service. It places it at

the topmost round of all terrestrial life. It assigns it the honorable distinction of being a specialized abode and instrument for the temporary use of man. It withholds from it no meed of dignity, except to deny it the preeminence of being man. Has it the excellence of being true? It will be observed that while it denies to the body the honor of being man, it affirms that it is man's body—his body, though not himself.

Precisely what do we mean by this? We mean that it is his body, not that it is himself; that so long as it lasts it is his for residence and use, and exclusively his. In no other respect is it his, and in no respect is it he.

We now wish to add, before passing from this point, he is not its maker or complete proprietor, as it is not his maker or proprietor. The same Maker made them both, and made them for each other. Neither exists of or for itself alone. The body serves; in turn, the man is the caretaker.

While the body serves the man, and the man in turn is caretaker to the body, he is not complete proprietor or complete custodian. The body has many functions for itself with which the man has nothing to do. He is wholly void of power over its vital processes. Its heart and lungs and stomach and viscera carry on their work independently of him—without his suggestion or permission, and above his power of prevention. Its life carries forward these processes in its own interests and asks nothing of him—is as independent of him as if he were not in the house. Its five senses are only partially under his control—he is but partial proprietor. The animal soul also has a life of its own independent of him, it has longings which he cannot prevent; he has no power over its impulses, but certain of its impulses are under his control so far as their indulgence is concerned. He cannot avoid feelings and sensations of various kinds on occasions.

The body in which the man is placed is not simply a structural arrangement of parts for his use. It has a life of its own—the highest type of animal life—a something analogous to the spirit in the merely animal—a functional spirit for it, which lives and perishes with it—a soul passionful, instinctive, automatic, impersonal.

When we deny that the body in which man is now shrined is an essential part of his real self we but assert that the decomposition of the present body is not the obliteration or destruction of the man; a doctrine held sacred among all Christian people. The body dies. The man survives. When the body dies its companion, the earth or animal soul, having no further function, perishes with it. The man or spiritual soul lives on if the doctrine of immortality is true.

As the body which he inhabits and uses is not he or of him, so its animal soul or spirit is not he or of him. It has an existence of its own, and is under him and for his service. He dwells in and pervades both, and is affected by them and responsible for their government and right use.

But it must not be inferred that dislodgment from his earthly body, which served him as a temporary home in this time life and was furnished him for certain useful functions while he remained on the earth, implies that henceforth he exists without a body. The cessation by death of its functions, and of the animal soul which used it as an instrument to certain earthly ends, probably does not leave the man without the need of a body for his use and service in his onward progress in the life which he continues to live. He that made the earthly organism of both material structure and earth soul for temporal functions, now provides another tenement suited to the higher sphere to which the immortal tenant is advanced. This is the

explicit teaching of revelation.* Man will continue to live in a finite and material universe, and among finite intelligences in whose fellowship and communion of life and activity he will have his growth and future experiences. For such ends he will need not such a body as he has now adapted to his present state, but a body suited to the state to which he shall be advanced. It will be a glorious body, but there, as here, it will not be himself, or an essential part of himself, but only a useful instrument.

But now it remains to furnish the proof that the man is a distinct being from the organism, and not simply a mode of it; an inhabitant, and not the house; a being of different essence and attributes. How do we discover this?

If this can be shown, and if additionally it can be shown that the organic structure cannot account for this new kind of being, then we utterly destroy the foundation of both the development and evolutional theories, which in principle are identical, and at the same time demonstrate that man is an absolute creational product.

It is conceivable that organic evolutionism might be true even in its extremest form—given life, especially given the animal germ, that all types have resulted therefrom by progressive variation through vast ages; for that would be merely saying that God, who is himself the energizing principle of life, so exercised his energy as to evolve each variety through antecedent forms, it would be really but a miracle of origins—but the conceivable supposition is wholly without proof and in violent antagonism to all proof, and therefore irrational; but, if it were established, it would prove nothing as to the evolutional descent of man.

It is admitted that for the introduction of the germ there is

* See First Epistle to Corinthians xv, 38–54 inclusive. See also *Beyond the Grave*, by the author.

no possible explanation without creative agency—given the eternal atom, it would still be impossible. These are facts which are practically admitted by all scientists. The theory of spontaneous generation is abandoned. The gulf between the unliving and living universe, it is conceded, cannot be bridged without creative agency, or direct constructive energy, and also it is practically conceded that the principle of life in insensate forms, or as discovered in the vegetable, does not explain sensate life—that the gulf between the two kinds is impassable without special energizing.

Repeating that evolutionism is an unproved theory—that is, that there is absolutely no proof that the principle exists at all; that in a single instance either in the vegetable or animal realm one genus or even one distinct species has ever passed into another or essentially changed its type—we now affirm that if it were granted to its largest claim it would still fail utterly to establish the derivative theory of man's origin. Given that life was introduced in organific form, first in the most rudimental germ, and that it was such that by inherent laws it translated itself from the lowest to the highest type, it would still be impotent to account for man.

What it would show, and the utmost it would show, would be this, that in a mode of creative energizing out of inorganic substances the Creator had developed all organic types, from rudimental spore to the human body, and that when this organic type was reached, then, and not till then, the adequate organism having been developed, man was created and posited in the body prepared for him. This is the furthest possible reach to which the theory could carry if it were admitted, and if it were proved it would not disturb theistic philosophy nor, as we believe, necessarily overthrow the Genesis account. But we are not here set for its defense. We seek simply the facts of the universe.

Our contention is that man is a spirit temporarily shrined in a body, and in no respect identical with it or evolved from it; that man is a person, and that all the attributes which inhere in personality are spiritual; that he is a child of God, created in the image of his Maker; and that the body is simply his dwelling place and servant, conditioning his existence, but not a part of him or in any sense source of his being.

Now what is the proof we have to offer in support of this postulate?

What do we mean by spirit? To this question we answer: Spirit is a substance having none of the attributes or qualities of matter. It does not come to knowledge through the senses or by sense cognition. It is unfigurable, invisible, intangible, imponderable, and unapproachable by any sense. God is a spirit. Man is of the same essence and possessed in a finite degree of the same attributes. He is the image of his Maker.

The attributes or characteristics of spirit are intellect, sensibility, and will, self-consciousness and a conscience. It is a kind of being which, while destitute of the attributes of matter, has power to know, to feel, and to will, to discover right and wrong, and feel obligation to the right. Wherever there are these powers a being possessing them must exist. Man is a being who possesses these powers.

How do we know this? Just as we know that God is such a being, namely, not by direct cognition, but by beholding visible and tangible effects of his action. We do not see God, but in the universe we see that he is. In the same way we know that man is a spirit. We do not see him. He is as invisible as God. No man ever saw a man, not even himself. We see the body in which the man is, just as we see the universe in which God is. The things which we behold show that God is in them directing and ordering them. Thus we know him.

The body in which a man dwells, in the same way, by observing its actions, shows that a spirit inhabits and directs it. When we see the body we do not see the spirit, but when we study its movements we see that a spirit exists in it, by seeing intuitively that if an intelligent being did not direct its actions they could not take place. We see the body and hear it pronounce an oration, pronounce words which are coherent and packed with thought; make a watch, write a book. We know that there must be a being who directs its action, who selects the words, guides the tools, controls the pen. We know that there is such a being, though we are not able to see or touch him, just as certainly as we know that there is a body, which we perceive performing these actions. Man is that invisible being. The body does none of these things of itself—is utterly incapable of doing them.

But we have a still more indisputable proof, if that were possible, namely, the proof of consciousness. Man knows that he is a spirit. How? By knowing that he thinks, knows, and wills, and has power over all his own acts. He knows that his body is a thing which is objective and external to himself, that while there are internal economies of it which he cannot fully understand or control it is a creature which is subject to him and obeys his bidding. He commands it and it goes or stops; takes the tool up, uses it, lays it down under his supervision. He conceives a sentence, or a picture, or any work of art; he directs the hand to execute it. If man knows anything he knows that he is free master in his house, and that the house is not himself. The house in which he lives is also a kit of tools—its hands, its feet, its eyes, which he employs in every variety of way at his pleasure. It was made for him and put under him for his use.

There is still another proof. Man's body grows and comes to

its stature by one set of means, and has one set of needs; he grows and comes to his stature by another set of means, and has another set of needs. His body takes food in a stomach and transmutes it into tissue. But it does not even do this without his compelling it. The food is material substance, is of the earth; the made tissue is of the same identical earthy substance. The body is so built and has no other element in it. It increases in weight, stature, texture, is figured as has relations of parts, is taken to pieces and returns to dust. That is the whole fact.

He does none of these things: is not a structural arrangement of parts, has not a stomach, does not eat food, is not formed of material tissue, is not a figured thing, does not increase in figure, size, or weight. His body does not think or reason—has no power to form ideas, or to reason or understand. He thinks, reasons, investigates, is self-conscious. He grows in power and faculty, increases in knowledge, and becomes more than he was, by the stores of knowledge and ideas which he acquires, and by increase of personal faculty which develops in him by use. He rises thus from infancy to manhood, and there is no limit to his possible development. His development is a spontaneity of his essence—is not wrought by some extrinsic force—is personal and subject to personal self-determination. He grows if he will, and shrivels if he will so permit. All knowledge is open to him, and he is dowered with faculty, but attainment depends on personal effort. Thus he shows his existence, and determines his own character of worthiness or unworthiness.

He commands the body. It does nothing but exist and feel external impingement without his bidding. When it walks, he moves its feet, directs its course; when it speaks, he selects its words and operates the organs; when its wants press it with hunger or distress, he is its provider and doctor. He

makes it provide shelter and clothing to protect it from the weather and other unfriendly or harmful enemies. It does nothing without him.

And still again his body is subject to laws of decay and disintegration. His body, the organism, cannot live on. It is under the law of necessity. It must die. It was made for death. The agencies that are corporate in it doom it to ultimate disintegration. It has no elements of permanence. Its permanence as it now is would be his greatest misfortune. Useful for a time, its continuance forever would be an incumbrance. He, on the other hand, is dowered for permanence. His higher and coming wants demand another kind of body, to which he will come in due time.

The inadaptability of the animal organism, and its necessities and functions to the permanent wants of the inhabiting spirit, demonstrate that it is neither an essential or permanent integrent of the man. Only that is or can be essential that is inseparable and constituent; that is, that which cannot be removed or impaired or substituted with something different without destroying the man himself.

Man may be such a being that some kind of organism resembling in some measure the kind of organism which he now possesses will be a permanent necessity to him, conditioning his highest well-being in many ways without being in any sense a component part of him—be what the present body is, a habitation, a medium of fellowship, and a condition of certain forms of activity and enjoyable experiences. There may be, as the Scriptures affirm there is, "a natural body and a spiritual body," the former adapted to the present sphere, "a body of flesh and blood," which cannot enter into the kingdom of permanent life, and "a spiritual body" that is made for that state. All analogies of the processes discoverable in the ongoing of the universe are in harmony with the scriptural theory.

Yet once more, that a being is, and the kind of being it is, is seen by noting the effects it produces.

What is man in the light of this standard? What does man do? What has he done? Take his world, that is, the world of his creation. Where there are effects there are adequate causes. This is a universal law. The law determines what kind of being man is.

God made the inorganic universe. It proclaims his eternity and power. He made the organic in both realms—the vegetable and animal—insensate and sensate life. All the varieties of both kinds, from the azoic up through all the following ages until to-day show not simply that he is, and that he is infinite in power, but that he has infinite resources of wisdom. Only the fool fails to detect his existence, and only the blasphemer denies it. Why? Not because they see him, for this they do not, but because the universe declares that he must be, as its cause. His works declare him. (Rom. i, 20.)

Apply the principle for the elucidation of the problem of man.

We do not see man, as we do not see God, and for the same reason, that he is not a material being. There are two things —a material organism, and results of actions in and through it. These tell the story of man, both that he is and what he is. How? We shall see in the following statement.

We have seen that for millions of years there existed simply inorganic matter, first as atoms, then in collocations and world masses and economies. Then for vaster ages following that there were living organic existences. We have seen that the inorganic produced nothing, but was itself wrought by an external worker. We have seen, also, that the organic produced nothing; but living, it ran a round of automatic activities and perished, leaving only its casts in the growing strata which told of the world's age and the epochs in which they lived. They left no monuments of art or construction to indicate that

they had any powers of any kind. They still exist in new and advanced varieties, and still die without memorials.

A few thousand years ago a new and higher—highest type of organism appeared on the planet, similar and yet dissimilar to all that had preceded it. Had it been a mere organic existence it would have lived and perished, and, like its predecessors, have left no memorials but its casts in the forming strata of its time.

But it was not like them, or rather it was like them, but it was found to be something more, or rather yet not to be, in itself, something more, but to be the home of another order and kind of being. How? By what it has done. With this creature a new world began, a world of its creation, monumental of its handiwork.

What is this new world, fathered by this newly arrived being, and how did he proceed in its construction?

There are two questions; take them separately: First, what is the world of man's creation; or, if not of his creation, of his development?

What has he made? When he appeared he had nothing but his body and the inorganic and organic substances which he found existing about him, and his own personal powers. He did not even possess developed knowledge. He was in all respects absolutely naked. He had everything to learn, and with no tools with which to commence business but his personal faculties and the instruments furnished in the body given him as a place of abode. The earth lay about him and the forms of the life he would need for food, and other materials his developing manhood would in a thousand ways require for his health and comfort, but which he would have to find, most of it concealed in the elements and hidden away in the earth and in the atmosphere, and in animal and vegetable substances.

Thus poor, and seemingly poorly equipped, he commenced a lonely stranger in the universe and on the earth, which was to be his temporary home. The elements were unfriendly, and much of the abounding life about him hostile and eager to make him a prey. He was unequal to cope with them, and without means of self-protection. They were fleeter and stronger than he. If his first consciousness was not one of surprise and terror, it could only be because of some strange inner support which ministered to his helpless need. What was his first thought and feeling who can surmise? He had no clothes, but was not ashamed. There were two of them, as after results show. They became acquainted and set up housekeeping in an empty world. We cannot think of them without being moved with sympathy. How lonely they must have felt, and frightened, too, when the sun went down, and when night came on and the stars came out! The earth was their bed and that wonderful sky of middle Asia their canopy. No doubt wearied and anxious nature slept sweetly that first night under that brilliant sky; we may hope it was calm and peaceful.

Next morning there were urgent needs of food. This had been provided for them. Moses tells the story in few and simple words, never improved upon, of the few succeeding days, and then of long, sad years. It is not a pleasing story. The refrain of sorrowful poverty and sin, which has never ceased, soon commenced. They go out into the great world to make a home. How helpless they look!

Behold the outcome! The start was lowly enough. He had no tools with which to set up business. Even his wants he had to learn—the wants of the animal organism in which he found himself resident, his own wants of knowledge and of the proper understanding of himself and surrounding objects. All was mystery.

Up to that time every creature that had life simply lived its time and died, leaving no memorials. This new being was of a different kind, and yet in some respects he seemed to be similar. He possessed a body of similar, yea, identical, elements. He had an earth soul similar to the earth soul of all the animal kinds which had preceded his coming millions of years, and many types of which were still filling the seas and forests of the world when he made his appearance. But it immediately became apparent that despite these external and accidental resemblances he was a different kind of being.

He immediately commenced to act as none of his predecessors or contemporaries acted, and to manifest a grade and kind of powers which they did not possess. The result is before us—the world of man's production. We distinctly and easily trace it back along the line of written and monumental history to its dawn. Research lays bare the stone age, succeeding it the bronze, leading up to the cult and culture of our time.

To appreciate man, and begin to comprehend the broad gulf between him and other creatures, one must ponder this amazing result; must be at the pains to go over the world and measure what he has done and what is in him yet to be done; must pursue him through the ages from the outdoor workshop in the plains of Middle Asia, where he factured his first stone ax and flint arrowhead, to the splendors of to-day. What a thrilling romance—not of fiction, but of tragic reality—as we follow down the wake of history and behold the busy worker and the ever-growing wonders of the product of his hands! What a march from the outdoor workshop and its stone hammer of ten thousand years ago to the great exposition of yesterday; to the workshops and factories of the most advanced nations; to the palatial homes and public buildings of the great

cities; to the museums and libraries and art galleries of all cultured and developed peoples; to the mighty steamers which ply all oceans and the steel highways which traverse all lands; and the telescopes which sweep all heavens, and the science which counts and weighs and calculates the movements of all solar and stellar systems! But to determine the grade and quality of man as differentiable from other creatures we must go further than simply to note what he has done; to the deeper discovery of how he has done it—the process reveals the worker; as we study this we soon discover that the agent is more than dumb forces, or product of dumb forces.

For the first time we reach a realm of self-consciousness. This new being knows himself, and knows the how of the world which he has made—where and how it originated—that it is an evolution of himself; that it sprang not from muscle and matter of his body under necessitating force, but from himself; that it first existed in him as idea; that then ensued in him a feeling of desire or motive, and then that he acted as a will, using his bodily frame as an instrument. Thus his world was made—evolved out of himself—one stage conditioning another.

But this new being differs from all that preceded him, not simply in the possession of a higher range of attributes and mode of working. He discovers also a unique quality—an ethical nature—a conscience—a sense of responsibility to a higher power for the use he makes of his faculties—obligation to good offices to others at the cost of self-denial. The simple law of selfishness which reigned in all other earlier and recent races, even of the highest type, is replaced in him by the higher and radically different law of regard to the welfare of others, even at the sacrifice of self. The struggle for life which explains all the effect of organic and sentient existence from the lowliest plant to the loftiest mammal, in this new being, is subordinated to a new law—the struggle for the life of others. We have

reached a new realm. Individual character takes on a new quality. We stand in the presence not simply of a being of structured organism, of hungry stomach, of sensitive nerves, of rapacious appetites, but in the presence of a being who measures and regulates himself by law, who respects others and recognizes the law of duty—a being who sees meaning in all things, and who determines present acts with respect to their bearings on the welfare of his fellows as really as his own in the long run of existence, and not in the light of present gratification or indulgence merely; a being who apprehends God and duty, and who looks forward to immortality; a being who is free master of himself, and not a creature of necessity; a creature made in the image of God, the Creator of all.

The spiritual distinguished from antecedent creation.

This new creation, the crown and glory of all, and last, requiring for its service all that preceded him, is distinguished by the possession of a new series of attributes and ultimate ends of existence unlike and impossible to all that preceded. To sensation it adds the faculty of forming ideas or concepts; to perception it adds insight and true cognition; to instinct it adds reason; to passion it adds appreciation and moral affection; to desire it adds a sense of the proper; to impulse it adds the feeling of obligation; to all it adds the sense of the true, the beautiful, the good; of right and wrong; of responsibility; of personal worthiness and unworthiness; self-consciousness, freedom, conscience. It is consciously not of the organism, nor for it, but only a temporary sojourner in it, and the organism is for it. It has a life of its own which is potential of interminable progress, and it lives in the hope of interminable existence after the organism is taken down. The full significance of this crowning creation will appear when we come to treat more specifically of man.

But before we leave this general survey, as having impor-

tant bearings on the discussion which is to follow on the nature, attribute, and character of God, it is essential that one more point should be raised, namely, the fact that the universe is still in process of development—is uncompleted. The uncompleted facts must be taken into the account, and will be found to be the most important of all as shedding light on the deepest nature of its builder.

The essential differentiation of man is freedom. This separates him from mere matter. Unfold this idea.

Man is an ethical being, and not a mere organism. Man in his ethical nature develops the fact that his author is an ethical being; possesses ethical attributes and character. This is a revelation not reached in all the preceding acts of the creative drama. There is absolutely no proof of a moral nature in God in all his antecedent acts. Sentient existence hints something, but in its actual history nothing as to his real ethical character; and man as a mere factor clothed with an ethical nature does not attain to the full significance of his existence until destiny is reached. The eternal outcome of the mighty drama must be taken into account. The end completes the revelation and puts all significance in all preceding parts. If man exists for a day, and then passes into oblivion as all other animals do, the character of his author will be one thing. If he is immortal, and has in him the possibilities of endless progress in good and happiness and ethical worthiness, the character of his author will be another thing. If it should be that all else will pass away as mere scaffolding, and this one matchless creation will remain and have a destiny determined on ethical grounds; if an everlasting kingdom shall thus rise upon a transient, preliminary, and preparative creation—a kingdom of righteousness and happiness—then the complete work will demonstrate not simply the power and skill of the great Worker, but more than that, that he is glorious in holiness, infinite in goodness, God over all, blessed forever.

Milton transforms them into angels, and has had a great following; but his dream is without proof. They were but a new and higher type of earthly beings, but with a dower of faculty which was to transform the world, and at the same time unfold the mystery of its meaning, and put significance into all its preceding history. It was the coming of the heir to his inheritance—the king of the world to his assigned dominion.

We will not trace his history adown the ages that have followed, but simply point to the proofs in the wonders he has wrought that he was of a new order of being. What are they? Would you look for his monument *circumspicere?* Man's creations are the proof of man's transcendence over nature.

Out of his powers has emanated the new and wondrous creation, only less marvelous than the antecedent creations of his great Father.

His first business was to search out the contents of his earth home, and then to subdue them to his use. He must find the metals in the rocks, and factor the tools for his service. What an undertaking!

No heir ever inherited so princely an estate with so clear a title, but no fortune was ever so concealed or difficult to make available.

What is the outcome? It will be impossible to make the complete inventory. Go abroad over the earth and behold and study. Out of that naked and lonely stranger has emanated all that his heirs possess to-day—the whole world of man's contrivance—all works of utility and art and civilization; all structures for his dwelling; all implements for his use, cities and their temples and merchandise; all machinery for his service of industry and labor and convenience; all learning and languages; all books, and their stored thoughts and researches and investiga-

tions; all crafts that ply the rivers and oceans, and all vehicles that carry on the traffic and travel of the land; all religions and science and philosophies; all governments and laws; all that makes the world a habitable world, and life in it a delight and pleasure. He has delved into the mines of the earth and rifled them of their concealed treasures; he has robed himself in garments of furs and fabrics; he has converted loose sands into translucent diamonds; he has extracted and disentangled the gases for illumination and heat; he has tamed and harnessed the lightning to be his obedient slave; he has counted and weighed the stars and determined their orbits; he has added a new eye a thousandfold more powerful than the one with which he was dowered by his Creator; he has compelled the sun to be his artist, and the winds to be his slave; he has extorted from the earth the story of its origin and the narrative of its growth and development; he has found out the Creator of all and ascertained his uncreated attributes; he has come into communion with his thought and feeling and motive and plan, and found him to be his Friend and Father; he has dared to believe himself immortal amid universal death and decay, and to defy nature to destroy him; he has shown himself to be worthy of immortality and an heir of the King eternal by the power in him of eternal progress, and the dower of freedom peculiar to himself.

The outcome.

Greatest of all, he has shown as his highest crown of excellence that he is an ethical being—not simply that he discerns the beautiful, but that he knows the good, and is conscious of obligation to the right, and is capable of virtue.

These inherent qualities and outwrought achievements proclaim him to be more than a clod wrought into an organism of curious living structure; proclaim him to be a being in nature and kind like his Maker, a child of God—not a thing of earth and dust: for now a denizen of an earthly tabernacle wrought in clay; ultimately an heir of heaven.

How did he accomplish these wonders? Two things of great importance discover themselves in the study of this problem—the problem of man's work and methods which have immediate bearing on the other problem of his nature. A spirit works under one law, and a clod or atom under another law. The one acts freely, the other is driven by necessity; the one acts personally, the other is acted on and in.

Now we are in a condition to know, not merely assume, that man acts under the law of a spirit, and therefore is a spirit. How does this appear? A spirit is first a knower, and then an actor. It has an idea; the idea begets desire; the idea is the bottom fact. Desire moves to action. Volitional activity is the resultant act. All things that exist are traced first to an idea, then to a will. For the idea and will we are compelled to predicate a being who has the idea and will. The idea is precedent to the act—is original pattern. The possessor of it is a spirit. Thus the universe first existed in idea before it existed in fact. The concrete fact declares the idea, and the being back of all who possessed it, and that in its production he acted as a will. The proof is of an eternal Being who had the idea and who wrought it into concrete form, but this shows that the universe emanated from a spirit. Spirit is before all and parent of all.

Man works as a spirit.

Now we know that man's achievements are of this kind. All his proper personal acts begin in idea. Would he build a house, a steamship, a watch, a telescope, paint a picture, write a book, do anything? First he forms the idea of the thing to be done. His primary creative act is the creation of the idea. This is purely an act of spirit—not possible to a lump of matter organized or unorganized. His next act is an act of will in the form of a determination to put into concrete reality what exists in idea. Then follows a forth-putting of power in executive volition.

To turn the idea or the ideal into concrete reality, man must use instruments. His will is impotent to direct creation. Only the infinite is equal to that. Man has a subordinate power. Would he create a watch or steam engine, a house, a picture, he must determine the idea. Then he proceeds to employ instruments. His first instrument is the organism furnished him through which he must act. If it is not sufficient, through it he must create other instruments. He is in such relations to the organism that he operates it volitionally or as a will. He compels it to serve him. Is it a picture he would paint? How does he proceed? First he forms the picture as an idea. It is purely a spiritual product. It exists nowhere but in him. Then he commands the body to make him an easel of a certain pattern, then a canvas of a certain size, and brushes and pigments. Then he commands the body to sit before the canvas, and take the brush and pigments and commence his work. The body does nothing that he does not command it to do—draws no line. He is the artist, he determines the pigment, its tone and color, he guides the brush. The finished picture comes from a spirit. It is so of all that man does in which intelligence is exercised.

So far we believe that we have given a rational and substantially correct version of the universe: as to its vastness in space; and as to the method of its unfolding in time through incomputable ages; and as to the history of life in the organic; and as to the transcendence of man in his essence and attributes over all other terrestrial existence. We are unable to find any disagreement in the facts and their order with what is clearly ascertained in the universe system. It must be proximately correct, or at least must be held so to be until other facts are discovered to modify it.

We have not aimed at a theistic rendering, though we believe that the facts demonstrate the theistic theory.

We have not concerned ourselves about a theodicy, but have sought simply to find the facts. The question of a theodicy is an entirely different question, and requires the facts before it is attempted. It will be reached in the treatises which succeed this.

But we have not reached all the facts yet. These must be yet further adduced—especially facts with respect to man.

Man as to the organism is mortal. There are no exceptions to this law. In this respect he is in strict analogy to all other organic existence. This fact rationally establishes the principle that all organic existence is by constitution mortal. And mortality or overthrow proves that that which is overthrown had a beginning, and so that the whole order had a beginning, since it is impossible that there should be a line with one end that has not two ends. Universal mortality has been denied by some theologians on what seems to them scriptural grounds. The question of fact needs, therefore, to be more fully considered.

Is it of no significance that every organic existence through all the ages of prehuman history has been mortal, and that the body of man is in every respect analogous to all the organic existence which preceded it and which is contemporaneous with it, subject to the same laws, and pervaded and environed with the same destructive influences and agencies?

Sin is assigned as the cause of man's mortality, but where the need for such a cause when all the evidences are that the organism itself shows that it was not made for permanence, but was designed for a transient tenement? Why assign a cause when another and obvious cause is known to exist, which is operative irrespective of that which is assigned? Is it answered? The Scriptures so affirm in direct terms, and that

settles it (Rom. v, 12). All depends on the meaning we attach to the term death in the passage. The assignment of sin as the cause carries with it the implication that but for sin the body would have escaped death, when the evidence is that mortality was its inevitable doom from causes corporate in its very nature; and when we know that there are reasons why its permanence would be untold calamity, no fact is more obvious than the fact that a body organized as man's body is was not intended or possible to be free from the common doom of mortality, or a radical change equivalent to its abolishment. If man is immortal, his present body was not intended so to be. Physical death or dissolution is a law of the universe, and man is no exception to the law.

Man, himself immortal.

But along with this is another fact, namely, that man himself is not mortal or subject to the law of death. This may be denied as unproved; but if allowed on any ground, the admission carries with it that man is a distinct order in the universe, and that his bodily organization, and whatever else is involved in it and for it, is not an essential constituent or any part of man, but only a temporary appendage, intended to answer an end and then vanish away.

The fact of man's immortality cannot be scientifically deduced, but of the fact there is abundant proof. The subject cannot be further treated here.

The further fact we allege in proof that man is a distinct order ranking above the merely organic, and above the animal or sentient organic, is that he is dowered with faculties which place him under laws peculiar to himself, and is capable of acts which subject him to reproaches or praise, impossible to any other creature—acts of virtue or of sin entailing on him blame and shame, or approvableness and worthiness, such as no other creature is capable of.

This fact, if it be a fact, and it is universally admitted, will be seen in its implication to raise man not simply to a distinct grade, but to a distinct kind of being.

Man a sinner.

It is a fact of the universe and one of great significance that man is a sinner. No scientific treatment of the universe is adequate that leaves out this fact. It is as much a problem for scientific treatment as is any other fact of the universe system. It is as proper a subject of inquiry as geology or astronomy, and involves more grave and serious questions and laws than do any of the so-called natural sciences.

What is sin? It is usual to define sin as transgression of law, or willful transgression of a known law. Even so inadequate a definition as this has in it high implications; and imparts to man not simply a bad eminence, but necessitates that he should be a unique being.

In all the universe as known to us there is no other being, from the atom to the highest organic existence, that willfully violates a known law, or places itself in opposition to law; and we will add, not a single being or thing that intentionally keeps its law, or has any idea or knowledge either of itself or its law. There is not an atom, inorganic, organic, or sentient, that is not under law, not one that is out of harmony with its law, and not one that knows or can know its law, and not one that willfully either obeys or disobeys its law. In the whole realm of life there is not an exception but man. The fact shows that he is *sui generis*, a creature after no other type.

But a better definition will make this still more plain. Sin is any self-determination or purpose of a free being or person to do an act, or any indulgence of a feeling, or any gratification of a natural passion which he knows or believes to be wrong, or any inexcusable neglect to show kindness to persons in distress where the opportunity offers, or any intentional unkindness or

any want of love unfeigned toward God or man—any violation of the law of God in thought, word, or deed, or in failure to keep it, of which the person is aware at the time when the intention exists or the neglect takes place.

The opposite of sin is virtue or righteousness. The possibility, and, more yet, the actuality of either of these acts or states, and the consequences which attend and follow them, show that man is a being of different character and quality from that of any other creature, and not a possible evolution of any other.

Man is an ethical being. He knows his law. He is free to its obedience or disobedience; he is conscious of obligation; he has a conscience; he adds to instinct a sense of duty; to impulses a power of repression or self-control. He discriminates, reflects, considers consequences, acts from moral motives. These are predicables of no merely organic being. He stands in awe and reverence before authority. He distinguishes between what is and what ought to be—is conscious of right and wrong—is capable of shame, remorse, and self-reproach and their opposites.

Man is a unique sufferer, and also capable of unique enjoyment. In common with sentient creatures, his sentient nature suffers, and in the same kind. He is so intimately related to it that its sufferings report and appear in his self-consciousness. But his sufferings proper to himself and his enjoyments are peculiar, and do not appear in the sentient orders. They are such as arise from his moral states and acts and from his rational nature purely. This unquestionable fact cannot be explained on any theory of evolution.

Finally, he is a creature capable of endless degradation of guilt or exaltation of worthiness. He is capable not simply of sentient experiences of pain and distress or pleasure, but of happiness and misery which result from purely moral causes; that

is, from inward conviction of failure to be or to do what he ought to be or to do, or for acts which he regards as wrong.

He is affected with hope and fear as he reflects on the kind of life he lives, the use he makes of his powers. He thinks of God, and stands in awe of an unknown future in view of what manner of man he is.

Clods or organisms of dust can have no such experiences as these. They demand a self-conscious and responsible subject. Man only in all the terrestrial universe is such a subject.

From the indisputable facts here alleged we hold that man is a unique being whose origin cannot be traced to evolution from any other order found dwelling upon the earth. The facts all harmonize with what is clearly taught in revelation. There is perfect harmony in every part. We have not in this treatise referred to revelation, or brought its authority to support any position taken, not because we place slight estimate upon its value as a witness. We believe it to be of the highest authority as proof, but our object is simply to find facts and base our conclusions on their inevitable implications. The theology of the facts of the universe is the theology of the Holy Scriptures.

The inevitable deduction is that man is a spirit shrined for a time in a body, and that he is a sinful and fallen spirit. For the present we pursue the subject no further. In a treatise to follow purely theological questions will be fully considered in the light of the facts here adduced and in the light of revelation.

Man a spirit.

In a former work, *Beyond the Grave*, the author treated of man simply as dual—composed of body and soul, or the animal man and the personal man. That treatise was not designed to deny the trichotemic doctrine. It was sufficient to the purposes of that discussion to affirm the radical dis-

tinction between the material and spiritual, the earthy and heavenly in man, the temporary and mortal, and the permanent and immortal. A strict analysis, we think, favors the tripartite view of man, and we did not mean to imply the contrary in that treatise. Conspicuously man is soul and body—mortal and immortal; particularly and strictly the lower animal soul belongs to the bodily life on the earth, and, though different, may be viewed as one with the body. Man is dual or triplex accordingly as we make a more strict or general analysis of his nature.

Trichotomy does not necessarily imply that *man* is triplex. The furthest it can carry is to show that man, as we find him, is in a complex of soul and body. These terms we think have real meaning and denote a fact. The body is one; the soul is another, and totally distinct from the body; and the term soul may have broader or narrower meaning, or may include both the broader or narrower meanings. The lower qualities are common with animals, the higher are peculiar to man; and the spirit still another, and may be totally distinct from both body and soul. The three are facts of man, that is, man is shrined in a body which is also the abode of an animal soul; and in this sense man is triplex as to his present mode of existence. But we shall now endeavor to show that two of the members of the complex are not essential to the man, and therefore not component parts, but only temporary incidents of his existence for a purpose.

The body is simply a physical form whose substance is of the common inorganic matter of the universe vitalized so that it grows from a germ to a state of maturity under a fixed law. The vitalization of the body is simply a form of energizing in matter by which it is built, as in the case of plants and other animal organisms. In the process of growing it is never the

same as to substance for a single day, and at the end of a few years every particle in it has completely changed so that not an atom of it remains. This is a well-known and undisputed fact. It cannot, therefore, as to substance be an essential constituent of man, if man himself is a permanent being.

The body so formed has shrined in it a semi-spiritual creature called by Trichotomists an animal soul, or ψυχή. It is similar to that of which is found in the whole realm of animal life. The organs of sensation which are in the body, called the five senses, convey impressions to this indwelling soul and awaken sensation in it and so determine its activities. The impulses awakened are all the forms of sensation—hunger, thirst, fear, lust, love of offspring, and such like. These constitute the life or experience of the animal soul, or ψυχή. They are wholly irrational and involuntary, and have their entire function for the preservation and propagation of the body, and are the same with difference of degree in all things that have animal life, and for the same purpose. Being irrational and involuntary they are unethical, but work under a strict law of necessity or mere instinct, and are the same in every respect in all animals, and without moral significance.

These two so-called components of man are simply animal adjuncts and exist for uses. The man has relation to them, as we shall see, but they are not of him. They are a divine arrangement for the propagation and service of human bodies and human life on the earth. Ultimately they die and disappear forever, having answered their end.

The animal soul is incapable of anything else than the sensitivities, instincts, and impulsions which relate to the preservation and propagation of the body. It has no proper intellectual

faculties or powers; is incapable of improvement; is void of reason; has no self-consciousness. There are semblances of mind: as memory, cunning, desire, fear, pleasure, but all falling below the grade of powers which appear in the human soul or spirit, the man himself—no real mind, even in the higher species.

The third so-called component of the man, but in fact not a component or constituent part but the man himself, is the spirit. (These terms spirit, *πνευμα*, and soul are used indiscriminately to signify the same thing.)

The man is a personal being, whose characteristics are the higher intellectual powers, spiritual emotions, and will, with forms of sensibility.

This nobler and more exalted being is possited in the body, and through it enters upon existence.

The senses of the body are prepared instruments for his use to open to him the avenues of knowledge. The uses he has for the body demand that he should be master of it, and have rational control of all its members; but also that his power should be limited to mastery of its uses.

The person so shrined in the body is also related to the animal soul which dwells in it. The relation is such that the person takes up in his consciousness all the impulses of every kind which are experienced by the inferior soul, and all the pains and distresses which infest it and the body itself—the passions and lusts of the one and pains and sicknesses of the other. They are motivities to action, but are subject to his rational and moral agency, and are totally void of ethical quality in themselves as mere impulses, which he in his proper personal action never can be.

Professor Drummond, in his recent work on the ascent of man, has a chapter on the evolution of mind, in which he holds

the following language: "That abundant traces of mind are found in the lower animals goes without the saying. But the range of mental phenomena discovered there may certainly excite surprise. Thus to consider only one set of phenomena—that of the emotions—all the following products of emotional development are represented at one stage or another of animal life: Fear, surprise, affection, pugnacity, curiosity, jealousy, anger, play, sympathy, emulation, pride, resentment, sense of the beautiful, grief, hate, cruelty, benevolence, revenge, rage, shame, regret, deceitfulness, sense of the ludicrous.

"If we turn from emotional to intellectual development the parallel line, though more faint, is at least shadowed. Again we find a list of intellectual products common to both animal and man, and again an approximate order common to both. It is true man's development beyond the highest point attained by any animal in the region of the intellect is all but infinite. Of rational thought he has the whole monopoly." This is as strong a statement as is warranted, and it marks a radical distinction. It shows that the spiritual in the animal is an incomparably inferior grade, and that the point of separation is so radical that the one cannot by mere evolution be lifted into the other.

In portions of the truly great discussion the author speaks as if he viewed nature and natural forces as causes of the universe —to the careless or even careful reader who is unable to understand some obscure passages he would seem to displace God, but evidently this is the furthest possible from his thought. His aim throughout is to show the coherent unity of the universe, and to point out the method of the divine Maker of the marvelous whole of his work from the inception in the created atom to the last result. Purpose presides over all the movement, and every force working the ever-advancing changes and outcomes is an energizing of the infinite cause—nothing is done

but by him. The amazing wonder rises from one degree to another, each precedent making way for and conditioning each succeedent, but never without the presence and agency of the prime cause.

He would seem at times to imply his acceptance of the theory that man, at least as to his body, traces his descent to the primitive one-celled life, and certainly is a lineal descendant of the earliest animal type. It is just that he should speak for himself, and we therefore quote him in full:

"In the evolution of a human habitation we have an almost perfect type of the evolution of that more august habitation, the complex tenement of clay in which man's mysterious being has its home. The body of man is a structure of a million, or a million million, cells. And the history of the unborn babe is, in the first instance, a history of additions, of room being added to room, of organ to organ, of faculty to faculty. The general process, also, by which this takes place is almost as clear to modern science as in the case of material buildings. A special class of observers has carefully watched these secret and amazing metamorphoses, and so wonderful has been their success with mind and microscope that they can almost claim to have seen man's body made. The science of embryology undertakes to trace the development of man from a stage in which he lived in a one-roomed house—a physiological cell. Whatever the multitude of rooms, the millions and millions of cells, in which to-day each adult carries on the varied work of life, it is certain that when he first began to be he was the simple tenant of a single cell. Observe, it is not some animal-ancestor or some human progenitor of man that lived in this single cell—that may or may not have been—but the individual man, the present occupant himself. We are dealing now not with phylogeny—the history of the race—but with ontogeny—the problem of man's ascent from his own earlier self. And the point at the

moment is not that the race ascends; it is that each individual man has once, in his own lifetime, occupied a single cell, and starting from that humble cradle, has passed through stage after stage of differentiation, increase, and development, until the myriad-roomed, adult-form was attained. Whence that first cradle came is at present no matter. Whether its remote progenitor rocked among the waves of primeval seas or swung from the boughs of forests long since metamorphosed into coal does not affect the question of the individual ascent of man. The answers to these questions are hypotheses. The *fact* that now arrests our wonder is that when the earliest trace of an infant's organization meets the eye of science it is nothing but a one-celled animal. And so closely does its development from that distant point follow the lines of the evolution just described in the case of the primitive savage hut, that we have but to make a few changes in phraseology to make the one process describe the other. Instead of rooms and chambers, we shall now read cells and tissues; instead of the builder's device of adding room to room, we shall use the physiologist's term *segmentation;* the employments carried on in the various rooms will become the functions discharged by the organs of the human frame, and line for line the history of the evolution will be found to be the same.

"The embryo of the future man begins life, like the primitive savage, in a one-roomed hut, a single simple cell. This cell is round and almost microscopic in size. When fully formed it measures only one tenth of a line in diameter, and with the naked eye can be barely discerned as a very fine point. An outer covering, transparent as glass, surrounds this little sphere, and in the interior, embedded in protoplasm, lies a bright globular spot. In form, in size, in composition there is no apparent difference between this human cell and that of any other mammal. The dog, the elephant, the lion, the ape, and a thousand others begin their widely different lives in a house

the same as man's. At an earlier stage indeed, before it has taken on its pellucid covering, this cell has affinities still more astonishing. For at that remoter period the earlier forms of all living things, both plant and animal, are one. It is one of the most astounding facts of modern science that the first embryonic abodes of moss and fern and pine, of shark and crab and coral polyp, of lizard, leopard, monkey, and man are so exactly similar that the highest powers of mind and microscope fail to trace the smallest distinction between them.

"The fact that any growing embryo is passing through a real development is decided by the new complexity of structure, by the more perfect division of labor, and of better kinds of labor, and by the increase in range and efficiency of the correlated functions discharged by the whole. In the development of the human embryo the differentiating and integrating forces are steadily acting and cooperating from the first, so that the result is not a mere aggregation of similar cells, but an organism with different parts and many varied functions. When all is complete we find that one suite of cells has been especially set apart to provide the commissariat, others have devoted themselves exclusively to assimilation. The ventilation of the house—respiration—has been attended to by others, and a central force pump has been set up, and pipes and ducts for many purposes installed throughout the system. Telegraph wires have next been stretched in every direction to keep up connection between the endless parts, and other cells developed into bony pillars for support. Finally, the whole delicate structure has been shielded by a variety of protective coverings, and after months and years of further elaboration and adjustment the elaborate fabric is complete. Now all these complicated contrivances—bones, muscles, nerves, heart, brain, lungs—are made out of cells; they are themselves, and in their furthest development, simply masses or suites of

cells modified in various ways for the special department of household work they are meant to serve. No new thing, except building material, has entered the embryo since its first appearing. It seized whatever matter lay to hand, incorporated it with its own quickening substance, and built it into its appropriate place. So the structure rose in size and symmetry, till the whole had climbed, a miracle of unfolding, to the stature of a man.

"But the beauty of this development is not the significant thing to the student of evolution; nor is it the occultness of the process nor the perfection of the result that fill him with awe as he surveys the finished work. It is the immense distance man has come. Between the early cell and the infant's formed body the ordinary observer sees the uneventful passage of a few brief months. But the evolutionist sees concentrated into these few months the labor and the progress of incalculable ages. Here before him is the whole stretch of time since life first dawned upon the earth; and as he watches the nascent organism climbing to its maturity he witnesses a spectacle which for strangeness and majesty stands alone in the field of biological research. What he sees is not the mere shaping or sculpturing of a man. The human form does not begin as a human form. It begins as an animal; and at first, and for a long time to come, there is nothing wearing the remotest semblance of humanity. What meets the eye is a vast procession of lower forms of life, a succession of strange inhuman creatures emerging from a crowd of still stranger and still more inhuman creatures; and it is only after a prolonged and unrecognizable series of metamorphoses that they culminate in some faint likeness to the image of him who is one of the newest yet the oldest of created things. Hitherto we have been taught to look among the fossiliferous formations of geology for the buried lives of the earth's past. But embryology has startled

the world by declaring that the ancient life of the earth is not dead. It is risen. It exists to-day in the embryos of still living things, and some of the most archaic types find again a resurrection and a life in the frame of man himself.

"It is an amazing and almost incredible story. The proposition is not only that man begins his earthly existence in the guise of a lower animal embryo, but that in the successive transformations of the human embryo there is produced before our eyes a visible, actual, physical representation of part of the life history of the world. Human embryology is a condensed account, a recapitulation or epitome of some of the main chapters in the natural history of the world. The same processes of development which once took thousands of years for their consummation are here condensed, foreshortened, concentrated into the space of weeks. Each platform reached by the human embryo in its upward course represents the embryo of some lower animal which in some mysterious way has played a part in the pedigree of the human race, which may itself have disappeared long since from the earth, but is now and forever built into the inmost being of man. These lower animals, each at its successive stage, have stopped short in their development; man has gone on. At each fresh advance his embryo is found again abreast of some other animal embryo a little higher in organization than that just passed. Continuing his ascent that also is overtaken, the now very complex embryo making up to one animal embryo after another until it has distanced all in its series and stands alone.

"The duration of this process, the profound antiquity of the last survivor, the tremendous height he has scaled, are inconceivable by the faculties of man. But measure the very lowest of the successive platforms passed in the ascent, and see how very great a thing it is even to rise at all. The single cell, the first definite stage which the human embryo attains, is still the

adult form of countless millions both of animals and plants. These simple cells are perfect living things. The earth, the water, and the air teem with them everywhere. They move, they eat, they reproduce their like. But one thing they do not do—they do not rise. These organisms have, as it were, stopped short in the ascent of life. And long as evolution has worked upon the earth the vast numerical majority of plants and animals are still at this low stage of being. So minute are some of these forms that if their one-roomed huts were arranged in a row it would take twelve thousand to form a street a single inch in length. In their watery cities—for most of them are lake dwellers—a population of eight hundred thousand million could be accommodated within a cubic inch. Yet, as there was a period in human history when none but cave dwellers lived in Europe, so was there a time when the highest forms of life upon the globe were these microscopic things. See, therefore, the meaning of evolution from the want of it. In a single hour or second the human embryo attains the platform which represents the whole life achievement of myriads of generations of created things, and next day or hour is immeasurable centuries beyond them.

"Through all what zoological regions the embryo passes in its great ascent from the one-celled forms one can never completely tell. The changes succeed one another with such rapidity that it is impossible at each separate stage to catch the actual likeness to other embryos. Sometimes a familiar feature suddenly recalls a form well known to science, but the likeness fades, and the developing embryo seems to wander among the ghosts of departed types. Long ago these crude ancestral forms were again the highest animals upon the earth. For a few thousand years they reigned supreme, furthered the universal evolution by ahair breadth, and passed away. The material dust of their bodies is laid long since in the paleozoic

rocks, but their life and labor are not forgotten. For their gains were handed on to a succeeding race. Transmitted thence through an endless series of descendants, sifted, enriched, accentuated, still dimly recognizable, they reappeared at last in the physical frame of man. After the early stages of human development are passed the transformations become so definite that the features of the contributory animals are almost recognizable. Here, for example, is a stage at which the embryo in its anatomical characteristics resembles that of the vermes, or worms. As yet there is no head, nor neck, nor backbone, nor waist, nor limbs. A roughly cylindrical headless trunk—that is all that stands for the future man. One by one the higher invertebrates are left behind, and then occurs the most remarkable change in the whole life history. This is the laying down of the line to be occupied by the spinal cord, the presence of which henceforth will determine the place of man in the vertebrate subkingdom. At this crisis the eye which sweeps the field of lower nature for an analogue will readily find it. It is a circumstance of extraordinary interest that there should be living upon the globe at this moment an animal representing the actual transition from invertebrate to vertebrate life. The acquisition of a vertebral column is one of the greatest marks of height which nature has bestowed upon her creatures; and in the shallow waters of the Mediterranean she has preserved for us a creature which, whether degenerate or not, can only be likened to one of her first rude experiments in this direction. This animal is the lancelet, or amphioxus, and so rudimentary is the backbone that it does not contain any bone at all, but only a shadow or prophecy of it in cartilage. The cartilaginous *notochord* of the amphioxus nevertheless is the progenitor of all vertebral columns, and in the first instance this structure appears in the human embryo exactly as it now exists in the lancelet. But this is only a

single example. In living nature there are a hundred other animal characteristics which at one stage or another the biologist may discern in the ever-changing kaleidoscope of the human embryo.

"Even with this addition, nevertheless, the human infant is but a first rough draft, an almost formless lump of clay. As yet there is no distinct head, no brain, no jaws, no limbs; the heart is imperfect, the higher visceral organs are feebly developed, everything is elementary. But gradually new organs loom in sight, old ones increase in complexity. By a magic which has never yet been fathomed the hidden potter shapes and reshapes the clay. The whole grows in size and symmetry. Resemblances, this time, to the embryos of the lower vertebrate series flash out as each new step is attained—first the semblance of the fish, then of the amphibian, then of the reptile, last of the mammal. Of these great groups the leading embryonic characters appear as in a moving panorama, some of them pronounced and unmistakable, others mere sketches, suggestions, likenesses of infinite subtlety. At last the true mammalian form emerges from the crowd. Far ahead of all at this stage stand out three species—the tailed catarrhine ape, the tailless catarrhine, and last, differing physically from these mainly by an enlargement of the brain and a development of the larynx, man.

"Whatever views be held of the doctrine of evolution, whatever theories of its cause, these facts of embryology are proved. They have taken their place in science wholly apart from the discussion of theories of evolution, and as the result of laboratory investigation made for quite other ends. What is true for man, moreover, is true of all other animals. Every creature that lives climbs up its own genealogical tree before it reaches its mature condition. 'All animals living, or that ever have lived, are united together by blood relationship of

varying nearness or remoteness, and every animal now in existence has a pedigree stretching back, not merely for ten or a hundred generations, but through all geologic time since life first commenced on the earth. The study of development has revealed to us that each animal bears the mark of its ancestry and is compelled to discover its parentage in its own development; the phases through which an animal passes in its progress from the egg to the adult are no accidental freaks, no mere matters of developmental convenience, but represent more or less closely, in more or less modified manner, the successive ancestral stages through which the present condition has been acquired.'* Almost foreseen by Agassiz, suggested by Von Baer, and finally applied by Fritz Müller, this singular law is the keynote of modern embryology. In no case, it is true, is the recapitulation of the past complete. Ancestral stages are constantly omitted, others are overaccentuated, condensed, distorted, or confused, while new and undecipherable characters occasionally appear. But it is a general scientific fact that over the graves of a myriad aspirants the bodies of man and of all higher animals have risen. No one knows why this should be so. Science, at present, has no rationale of the process adequate to explain it. It was formerly held that the entire animal creation had contributed something to the anatomy of man; or that, as Serres expressed it, 'Human organogenesis is a transitory comparative anatomy.' But though man has not such a monopoly of the past as is here inferred—other types having here and there diverged and developed along lines of their own—it is certain that the materials for his body have been brought together from an unknown multitude of lowlier forms of life.

"Those who know the Cathedral of St. Mark's will remember how this noblest of the stones of Venice owes its greatness

* Marshall, *Vertebrate Embryology*, p. 26.

to the patient hands of centuries and centuries of workers, how every quarter of the globe has been spoiled of its treasures to dignify this single shrine. But he who ponders over the more ancient temple of the human body will find imagination fail him as he tries to think from what remote and mingled sources, from what lands, seas, climates, atmospheres, its various parts have been called together, and by what innumerable contributory creatures, swimming, creeping, flying, climbing, each of its several members was wrought and perfected. What ancient chisel first sculptured the rounded columns of the limbs? What dead hands built the cupola of the brain, and from what older ruins were the scattered pieces of its mosaic work brought? Who fixed the windows in its upper walls? What winds and weathers wrought strength into its buttresses? What ocean beds and forest glades worked up its coloring? What love and terror and night called forth the music? And what life and death and pain and struggle put all together in the noiseless workshop of the past and removed each worker silently when its task was done? How these things came to be biology is one long record. The architects and builders of this mighty temple are not anonymous. Their names and the work they did are graven forever on the walls and arches of the human embryo. For this is a volume of that book in which man's members were written, which in continuance were fashioned, when as yet there was none of them.

"The descent of man from the animal kingdom is sometimes spoken of as a degradation. It is an unspeakable exaltation. Recall the vast antiquity of that primal cell from which the human embryo first sets forth. Compass the nature of the potentialities stored up in its plastic substance. Watch all the busy processes, the multiplying energies, the mystifying transitions, the inexplicable chemistry of this living laboratory. Observe the variety and intricacy of its metamorphoses, ex-

quisite gradation of its ascent, the unerring aim with which the one type unfolds—never pausing, never uncertain of its direction, refusing arrest at intermediate forms, passing on to its flawless maturity without waste or effort or fatigue. See the sense of motion at every turn, of purpose and of aspiration. Discover how, with identity of process and loyalty to the type, a hairbreadth of deviation is yet secured to each so that no two forms come out the same, but each arises an original creation, with features, characteristics, and individualities of its own. Remember, finally, that even to make the first cell possible stellar space required to be swept of matter, suns must needs be broken up and planets cool, the agents of geology labor millennium after millennium at the unfinished earth to prepare a material resting place for the coming guest. Consider all this, and judge if creation could have a sublimer meaning or the human race possess a more splendid genesis.

"From the lips of the prophet another version, an old and beautiful story, was told to the childhood of the earth, of how God made man; how with his own hands he gathered the bactrian dust, modeled it, breathed upon it, and it became a living soul. Later the insight of the Hebrew poet taught man a deeper lesson. He saw that there was more in creation than mechanical production. He saw that the Creator had different kinds of hands and different ways of modeling. How it was done he knew not, but it was not the surface thing his forefathers taught him. The higher divinity and mystery of the process broke upon him. Man was a fearful and wonderful thing. He was modeled in secret. He was curiously wrought in the lowest parts of the earth. When science came it was not to contradict the older versions. It but gave them content and a still richer meaning. What the prophet said, and the poet saw, and science proved, all and equally will abide forever. For all alike are voices of the unseen, commissioned to

different peoples and for different ends to declare the mystery of the ascent of man.

"Take away the theory that man has evolved from a lower animal condition, and there is no explanation whatever of any one of these phenomena. With such facts before us it is mocking human intelligence to assure us that man has not some connection with the rest of the animal creation, or that the processes of his development stand unrelated to the other ways of nature. That Providence, in making a new being, should deliberately have inserted these eccentricities, without their having any real connection with the things they so well imitate, or any working relation to the rest of his body, is, with our present knowledge, simple irreverence.

"Were it the present object to complete a proof of the descent of man one might go on to select from other departments of science evidence not less striking than that from vestigial structures. From the side of palæontology it might be shown that man appears in the earth's crust like any other fossil, and in the exact place where science would expect to find him. When born he is ushered into life like any other animal; he is subject to the same diseases; he yields to the same treatment. When fully grown there is almost nothing in his anatomy to distinguish him from his nearest allies among other animals—almost bone for bone, nerve for nerve, muscle for muscle he is the same. There is, in fact, a body of evidence now before science for the animal origin of man's physical frame which it is impossible for a thinking mind to resist."

From these citations it appears that the distinguished author believes in the derivation of man, at least as to his body, from the animal races, ascending through from the earliest to the last species.

If the facts of embryology are precisely as he states—and we

are not prepared to dispute the statement—they do not establish that for which they are cited, that is, the descent of man, even as to his body, through the successive types of preexisting animal races. The utmost point to which the facts can carry is the establishment of an ascending order of organisms from the most rudimental type to man, the most recent and most wonderful in the series; and the other remarkable circumstance, that each succeeding type is an advance. The alleged fact that the human embryo in the process of its development from inception to maturity takes on successively resemblance to the antecedent and inferior types proves nothing as to descent or derivation; the inference is unwarranted, and up to date is wholly without proof of any kind, and in violent contradiction of all that is known.

Fatal difficulties in the way of evolution.

The besetting and fatal difficulties of the materialistic evolution theory in any form in which it has been propounded or can be propounded are not simply that the assumed fact is improbable, but that it is utterly without plausible evidence, and that there are the highest evidences against it—in fact, that it is impossible.

Life might have been spontaneous and evolutional.

It is conceivable even that life might have been of spontaneous generation; that is, that matter might have been such that, in given conditions, life would appear in any and every form; and it might have been that life thus springing in the lowest form would develop into any other form and all other forms indifferently or by a regular process. The Infinite might have so arranged it that from a toad might spring a human offspring, or *vice versâ*, but he has not done it. The theory breaks down at every point for the want of evidence, and by the load of contradictive evidence.

The breaks in the chain of life are impossible on the principle of evolution, such as the break between unliving matter

and life; the break between vegetable and animal life; the break between animal life and conscious personal life; and, in fact, the break between any two species in the entire realm of life. Not an instance of spontaneous generation is made out. This is confirmed by the most eminent advocates of evolution, Huxley and Darwin both.

The germs of life or the living germs are definite. When posited in the earth and seas originally they were definite, each germ evolving its own special organism, and in no case departing from it; and each organism propagating its own type and no other. No attempt to confuse a germ by artificial methods, and cause it to miss its way and do something else than its appointed work, has ever succeeded or ever can. Time makes nothing in the case. Each germ pursues its fixed course without deviation through ages until it lapses and disappears from the realm of life; not an instance to the contrary can be shown. Species run close together, but they do not blend, or cross each other, or pass into each other, or propagate through each other. They have variable margins, but with fixed limits. They are what they are by an eternal decree. And why should they not be? To what purpose is it that we are asked to believe that each species was not distinct from the beginning? Does the theory serve any useful purpose? Does it solve any difficulty? Does it meet any æsthetic demand? Can anyone assign any reason why a man should believe that his original progenitor was *not* a man, but a beast, who had neither the power of speech, nor of reason, nor a conscience? If the numerous races and species in the vegetable and animal realms coexist now without trespassing upon each other's domain, nor confusing each other's pedigree; if seeds and germs now may be depended on to produce each its own kind, and if they never disappoint us by turning into

Species run close together.

Evolution relieves nothing.

something else, wherefore imagine that they were less loyal in other ages? Would it in any way be easier or more creditable to the Creator that he should derive his noblest creature, whom he honors as his child, from a brutal parentage, than that he should directly create him? Would the idea if accepted by man be conservative and promotive of his self-respect and of his sense of worthiness? Would it increase or diminish his sense of dignity and responsibility to class him among the offspring of beasts? *

* If none of these things, why accept a theory which is wholly void of evidence?

"The whole controversy at present conducted by the materialists and vitalists resolves itself into one question: Whether life springs from what Dr. Harvey calls a 'primordium'—a preexisting vital germ or unit—or whether it originates *de novo*, as the materialists assert, from infusions contained in the experimental flocks, or from plastide particles contained in protoplasmic matter, or from the still more daring of 'molecular machinery' as worked by molecular force? It is certain that the materialistic theory is quite as inexplicable, on the basis of analogical reasoning and microscopical investigation, as that indicated in the Bible genesis; while the vitalistic theory would seem to be more in harmony with vital phenomena, and prove the more rational hypothesis of the two. Besides, the Bible genesis answers to the logical necessity of predicating a determinate cause for each and every vital effect, or each living organism apparently springing from plasmic conditions, or mere structureless matter. Whenever the seeds of plants or trees are actually planted or sown in the earth his logical necessity rests on an induction impregnably laid in cause and effect; while the materialistic dogma *nihil* or *nihilo* would necessitate a like induction where seed is not sown. In either case the change that ensues is manifestly due to vital properties, whether the same be inhering in the seed or in necessary environing conditions. And the vital processes are the same, with the single difference as to actual environments.

"The germ in the seed is capable of assimilating by well-determined and thoroughly specialized processes the nutrient matter contained in the environment, precisely as the 'primordial germ' develops under its environing conditions. From the moment they strike their rootlets into the ground the process of development and growth are the same. The only point, however, necessary to make in this connection is that when we go back to the first living organism of a species—its primordially developed form—we necessarily reach environing conditions within which there is no such thing as a germ cell with exterior environments corresponding to the testa of the seeds, or to any conceivable notion we may have of seeds themselves.

"At this point—one not merely theoretical or speculatively possible only, but absolutely fixed and determinable in our backward survey of the vital forces of na-

We have already conceded that the theory is not *necessarily* atheistic; but, suppose it should be accepted, would it make *for* theism, or *against* it? Let it be supposed that life is a spontaneous product of matter, and that all its types are accidental varieties—and this it must be, or it must be the product of an *ab extra*, supermaterial cause—would it *increase* or *diminish* the hold of theism? If it would diminish the force of the evidence of the existence and governance of a personal God—and who can doubt it?—would it make *for* the moral interest and welfare of mankind or *against* it? Would it *lessen* or *intensify* the motives to virtue? Would it *strengthen* or *weaken* the hope of immortality? Would it *tighten* or *loosen* the bonds of morality? To ask these questions is to answer them. That the prevalence of the theory would be deadly will only be disputed by those who do not estimate properly the springs of human action, or who are indifferent to consequences. The question in issue is by no means an indifferent one. But it is not because of possible evils in the theory that it is condemned. If it were true despite these it would have the highest right to acceptance. But being false, and without a shadow of evidence for its support, these gentlemen, many of them illustrious for learning, and some of them of high position and influence, and claiming to be Christian, lending it their name and support, must be held

Not necessarily atheistic.

Tends to atheism and immorality.

ture—we find individual parentage lost in a natural matrix, or in the vital principle implanted, or a 'primordium' in the earth itself. To this inevitable induction of Dr. Harvey we are all driven in the end by those intuitive processes of reasoning which are hardly less conclusive than mathematical induction itself. We may call these 'primordium,' plastide postules, bioplasts, vital units, or whatever we will—the name is nothing, the working process is everything. Scientific speculation accomplishes nothing, therefore, by its new terminology except to confound the ignorant and astonish the wise. To call the homogeneous basis of an egg 'blosima' and its germinal point a 'blostia' is all well enough in its way, but it adds no new knowledge or additional wealth of language wherewith to predicate vital theories, whether they relate to the progeny of a hencoop or the lair of a tiger in an Indian jungle."—*Life, Its True Genesis*, Wright, p. 26.

responsible for aiming a deadly blow at the dearest interests of men by unsettling the foundations of faith and morality without cause and against the plainest reasons. It may seem to them to be an innocent holiday sport, a mere pleasing and harmless sensation, of which they are the heroes; it may amuse and tickle their vanity to witness the commotion they create. But the hallucination has so taken possession of us that nature is a real something which has power and exerts it according to fixed rules that we do not get rid of it easily. It must be absolutely eradicated before we can come to right thinking, and it can only be eradicated by not simply pointing out its error, but by extracting its root.

Let us, then, understand the term nature as describing a something that has real existence—that is the equivalent of things; nature is all things that are made—it is the sum of things. Now, if we add law as existing in things, we have as nature things and their laws. But now if we inquire for the meaning of this added term law we have as the answer, A rule according to which things act. If now we ask who makes the rule, what must the answer be? Do things make their own rules? The only possible answer must be, He that made things appointed their laws. Then if we include these laws in the term nature we have as the result things and the will of God, which is their source and law. Thus we see that law finds its home not in things, but in the mind of the Creator of things. We include God in the term nature, and we make laws of nature the simple equivalent of God's purpose as to how things shall be ordered.

But once more: laws are not themselves *de facto* things, or rather let us ask, Are they *de facto* things? If they are things existing among other things how shall we define them? The answer to which we are driven must be that a law is an idea or rule of thought as to what an act should be. Now, does the

idea exist in itself or in the thing? Does the atom have an idea when it acts according to an idea? The answer can only be one. The idea, according to which the act is required, is not in the atom as possessed by it, for that would make it intelligent; that is, it is not in nature, for the sum of atoms is nature; but it must be somewhere, it cannot stand alone. It is in the eternal Mind, and when it shows itself in the atom it reveals the eternal Mind as present in the atom.

But again, since law is not a being, it does not execute itself, it is not in itself a self-regulating and self-acting something. In itself it does not exist. Who, then, executes the law—this law which is detected as existing in things? Do the things themselves execute the law, that is, do things conform themselves and their activities to what we are pleased to call their laws? Then things must apprehend laws. How else could they conform their action to laws? Could they themselves act according to infinitely delicate and infinitely wise laws and have no power to discern any laws? The supposition is preposterous. These things do neither know nor execute what we are pleased to call the laws of nature. The finding is that things do not act according to law or act at all. He that made things made them for a purpose. That purpose is accomplished by a method which he executes. That method among things is fixed and is the necessity of things, that is, the maker enforces the method, is the executor of law. The power that carries out the law is his power. If we choose to say, "But the power is in the atom," we do not object, if it be meant that it is exerted in the atom, but not by the atom. That, as we believe, is the exact fact. Nature's law is simply God's idea coupled with God's purpose—the plan of the universe pervading every part and seen in every movement. The idea has no other home but the divine mind, and the power which executes it has no other source; that is, God is source of all laws. Nature is a name which

men have invented to describe these regular and regulated ongoings.

The fallacy is in supposing a power lodged in nature or things to act intelligently without intelligence in the things that act, that is, power to act without the power to act, or, without the intelligence which is exhibited in the act.

Evolution is the forthputting or unfolding of a free being in a regulated system of effects which emanates from intelligence and volition. The universe is an evolution from such a source. It emanates from eternal wisdom and power as a free expression. Being what they are, it is what it is, and could not fail thus to be—the stream is germane to the fountain, the tree is product of the seed. There is nothing in the system that is not traceable to this infinite source. The conformity of all things to law, and the manifestation of law in all things, means simply that God regulates all, and there is nothing of which his will is not the regulator and cause.

Results of investigation.

The result of all investigation up to date may be summed up as the discovery of these several facts: (*a*) the existence and agency of an extramaterial, eternal, all-potent agent; (*b*) the production of inorganic matter; (*c*) the formation of worlds; (*d*) the creation of life, manifesting itself in organized varieties, vegetable and animal, and in that order; (*e*) living creatures in the animal organism characterized by feeling, instincts, preferences, affections, passions, susceptibility to pain and pleasure, and a general kind of automatic mentality, in varying degrees, below self-consciousness and personality; (*f*) man, a personal, self-conscious being, characterized by proper mental, moral, and spiritual endowments.

If it should be asked how, having discarded as unscientific, and in every way unsupported, the theory of naturalism in its

two aspects of spontaneous generation and evolution of life, we suppose life to have been introduced, that is, in what manner, we have to answer, in general by creation—life is the direct product of the infinite cause; in particular, in a manner to be described.

Life a direct creation.

As observed, the occult force called life manifests itself in organism, and without dispute is the builder of organism, and by necessity exists before the organism which it constructs, and so is not a product, directly or indirectly, of its own organism. It is shown thus to be an agent in its own right, and must possess the requisite endowments for the effects it produces. The theory that life is a product of organism commits the fallacy of putting the effect before the cause.

Life builds its organism.

At present, so far as can be ascertained, throughout all the realms of life, the life force is simply divine energy posited and exerted to build the original organism and to propagate other similar organisms in seeds or germs, animal and vegetable. These contain, with more or less enveloping matter, minute fulcra from which the building force enters—the real germ.

Life propagative.

In his final chapter in the book referred to Drummond himself concedes the whole ground we have contended for, and affirms that evolutionism is but another name for the divine method of bringing about varieties of organic existence. His great mistake is in assuming without proof and against proof the derivation theory as the method of the divine Worker. This, we think, is a great blunder, and harmful as great.

It is just that the distinguished author should speak for himself, and so we cite him at length:

"The secret of evolution lies, in short, with *the environment.* In the environment, in that in which things live and move and have their being, is found the secret of their being, and espe-

cially of their becoming. And what is that in which things live and move and have their being? It is nature, the world, the cosmos—and something more, some One more, an eternal intelligence and an eternal will. Everything that lives lives in virtue of its correspondences with this environment. Evolution is not to unfold from within; it is to infold from without. Growth is no mere extension from a root, but a taking possession of, or a being possessed by, an ever-widening environment, a continuous process of assimilation of the seen or unseen, a ceaseless redistribution of energies flowing into the evolving organism from the universe around it. The supreme factor in all development is environment. Half the confusions which reign round the process of evolution, and half the objections to it, arise from considering the evolving object as a self-sufficient whole. Produce an organism, plant, animal, man, society, which will evolve *in vacuo*, and the right is yours to say that the tree lies in the root, the flower in the bud, the man in the embryo, the social organism in the family of an anthropoid ape. If an organism is to be judged in terms of the immediate environment of its roots, the tree is a clay tree; but if it is to be judged by stem, leaves, fruit, it is not a clay tree. If the moral or social organism is to be judged in terms of the environment of its roots, the moral and social organism is a material organism; but if it is to be judged in terms of the higher influences which enter into the making of its stem, leaves, fruit, it is not a material organism. Everything that lives, and every part of everything that lives, enters into relation with different parts of the environment and with different things in the environment; and at every step of its ascent it compasses new ranges of the environment, and is acted upon, and acts, in different ways from those in which it was acted upon, or acted, at the previous stage.

"For what is most of all essential to remember is that not only

is environment the prime factor in development, but that the environment itself rises with every evolution of any form of life.

"Man, in his long pilgrimage upward from the clay, passes through regions of ever-varying character. Each breath drawn and utilized to make one upward step brings him into relation with a fractionally higher air, a fractionally different world. The new energies he there receives are utilized, and in virtue of them he rises to a third, and from a third to a fourth. As in the animal kingdom the senses open one by one—the eye progressing from the mere discernment of light and darkness to the blurred image of things near, and then to clearer vision of the more remote; the ear passing from the tremulous sense of vibration to distinguish with ever-increasing delicacy the sounds of far-off things—so in the higher world the moral and spiritual senses rise and quicken till they compass qualities unknown before and impossible to the limited faculties of the earlier life. So man, not by any innate tendency to progress in himself, nor by the energies inherent in the protoplasmic cell from which he first set out, but by a continuous feeding and reinforcing of the process from without, attains the higher altitudes, and from the sense world at the mountain foot ascends with ennobled and ennobling faculties until he greets the sun.

"What is the environment of the social tree? It is all the things, and all the persons, and all the influences, and all the forces with which, at each successive stage of progress, it enters into correspondence. And this environment inevitably expands as the social tree expands and extends its correspondences. At the savage stage man compasses one set of relations, at the rude social stage another, at the civilized stage a third, and each has its own reactions. The social, the moral, and the religious forces beat upon all social beings in the order in which

the capacities for them unfold, and according to the measure in which the capacities themselves are fitted to contain them. And from what ultimate source do they come? There is only one source of everything in the world. They come from the same source as the carbonic acid gas, the oxygen, the nitrogen, and the vapor of water, which from the outer world enter into the growing plant. These also visit the plant in the order in which the capacities for them unfold, and according to the measure in which these capacities can contain them.

"The fact that the higher principles come from the same environment as those of the plant nevertheless does not imply that they are the same as those which enter into the plant. In the plant they are physical, in man spiritual. If anything is to be implied it is not that the spiritual energies are physical, but that the physical energies are spiritual. To call the things in the physical world "material" takes us no nearer the natural, no further away from the spiritual. The roots of a tree may rise from what we call a physical world; the leaves may be bathed by physical atoms; even the energy of the tree may be solar energy, but the tree is itself. The tree is a thought, a unity, a rational purposeful whole; the 'matter' is but the medium of their expression. Call it all—matter, energy, tree—a physical production, and have we yet touched its ultimate reality? Are we even quite sure that what we call a physical world is, after all, a physical world? The preponderating view of science at present is that it is not. The very term 'material world,' we are told, is a misnomer; that the world is a spiritual world, merely employing 'matter' for its manifestations.

"But surely there is still a fallacy. These so-called social forces are the effect of society, and not its cause? Before they generate society, society has to regenerate them? True, but to regenerate is not to create. Society is machinery, a medium

for the transmission of energy, but no more a medium for its creation than a steam engine for the creation of its energy. Whence then the social energies? The answer is as before. Whence the physical energies? And science has only one answer to that. 'Consider the position into which science has brought us. We are led by scientific logic to an unseen, and by scientific analogy to the spirituality of this unseen. In fine, our conclusion is, that the visible universe has been developed by an intelligence resident in the unseen.'* There is only one theory of the method of creation in the field, and that is evolution; but there is only one theory of origins in the field, and that is creation. Instead of abolishing a creative hand, evolution demands it. Instead of being opposed to creation, all theories of evolution begin by assuming it. If science does not formally posit it, it never posits anything less. 'The doctrine of evolution,' writes Mr. Huxley, 'is neither theistic nor antitheistic. It has no more to do with theism than the first book of Euclid has. It does not even come in contact with theism considered as a scientific doctrine.' But when it touches the question of origins it is either theistic or silent. 'Behind the cooperating forces of nature,' says Weisman, 'which aim at a purpose, we must admit a cause, . . . inconceivable in its nature, of which we can only say one thing with certainty, that it must be theological.'

"The fallacy of the merely quantitative theory of evolution is apparent. To interpret any organism in terms of the organism solely is to omit reference to the main instrument of its evolution, and therefore to leave the process, scientifically and philosophically, unexplained.

"A child does not grow out of a child by spontaneous unfoldings. The process is fed from without. The body assimliates

* Balfour Stewart and Tait, *The Unknown Universe*, 6th edition, p. 221.

food, the mind assimilates books, the moral nature draws upon affection, the religious faculties nourish the higher being from ideals. Time brings not only more things, but new things; the higher nature inaugurates possession of, or by, the higher order. 'It lies in the very nature of the case that the earliest form of that which lives and develops is the least adequate to its nature, and therefore that from which we can get the least distinct clew to the inner principle of that nature. Hence to trace a living being back to its beginning, and to explain what follows by such beginning, would be simply to omit almost all that characterizes it, and then to suppose that in what remains we have the secret of its existence. That is not really to explain it, but to explain it away; for on this method we necessarily reduce the features that distinguish it to a *minimum*, and, when we have done so, the remainder may well seem to be itself reducible to something in which the principle in question does not manifest itself at all. If we carry the animal back to protoplasm it may readily seem possible to explain it as a chemical compound. And, in like manner, by the same minimizing process, we may seem to succeed in reducing consciousness and self-consciousness in its simplest form to sensation, and sensation in its simplest form to something not essentially different from the nutritive life of plants. The fallacy of the *sorites* may thus be used to conceal all *qualitative* changes under the guise of quantitative addition or diminution, and to bridge over all the difference by the idea of gradual transition. For, as the old school of etymologists showed, if we are at liberty to interpose as many connecting links as we please, it becomes easy to imagine that things the most heterogeneous should spring out of each other. While, however, the hypothesis of gradual change—change proceeding by infinitesimal stages which melt into each other so that the eye cannot detect where one begins and the other ends—makes such a

transition easier for *imagination*, it does nothing to diminish the difficulty or the wonder of it for *thought*.' *

"The value of philosophical criticism to science has seldom appeared to more advantage than in these words of the master of Balliol. The following passage from Martineau may be fitly placed beside them: 'In not a few of the progressionists the weak illusion is unmistakable that, with time enough, you may get everything out of next to nothing. Grant us, they seem to say, any tiniest granule of power, so close upon zero that it is not worth begrudging—allow it some trifling tendency to infinitesimal movement—and we will show you how this little stock became the cosmos, without ever taking a step worth thinking of, much less constituting a case for design. The argument is a mere appeal to an incompetency in the human imagination, in virtue of which magnitudes evading conception are treated as out of existence; and an aggregate of inappreciable increments is simultaneously equated, in its cause to *nothing*, in its effect to *the whole of things*. You manifestly want the same causality, whether concentrated in a moment or distributed through incalculable ages; only in drawing upon it a logical theft is more easily committed piecemeal than wholesale. Surely it is a mean device for a philosopher thus to crib causation by hairbreadths, to put it out at compound interest through all time, and then disown the debt.' †

"It is not said that the view here given of the process of evolution has been the actual process. The illustrations have been developed rather to clear up difficulties than to state a theory. The time is not ripe for daring to present to our imaginations even a partial view of what that transcendent process may have been. At present we can only take our ideas of growth from the growing things around us, and at the best these but

* Edward Caird, *The Evolution of Religion*, vol. i, pp. 49, 50.

† Martineau, *Essays, Philosophical and Theological*, p. 141.

make more apparent how little as yet we know about it. Nor is it asserted, far as these illustrations point in that direction, that the course of evolution has been a continuous, uninterrupted, upward rise. On the whole it has certainly been a rise; but whether a rise without a leap or break or pause, or—what is more likely—a progress in rhythms, pulses, and waves, or—what is unlikely—a cataclysmal ascent by steps abrupt and steep, may possibly never be proved.

"There are reverent minds who ceaselessly scan the fields of nature and the books of science in search of gaps—gaps which they will fill up with God. As if God lived in gaps! What view of nature or of truth is theirs whose interest in science is not in what it can explain, but in what it cannot; whose quest is ignorance, not knowledge; whose daily dread is that the cloud may lift, and who, as darkness melts from this field or from that, begin to tremble for the place of his abode? What needs altering in such finely jealous souls is at once their view of nature and of God. Nature is God's writing, and can only tell the truth; God is light, and in him is no darkness at all.

"If by the accumulation of irresistible evidence we are driven —may not one say permitted?—to accept evolution as God's method in creation, it is a mistaken policy to glory in what it cannot account for. The reason why men grudge to evolution each of its fresh claims to show how things have been made is the groundless fear that if we discover how they are made we minimize their divinity. When things are known, that is to say, we conceive them as natural, on man's level; when they are unknown, we call them divine—as if our ignorance of a thing were the stamp of its divinity. If God is only to be left to the gaps in our knowledge where shall we be when these gaps are filled up? And if they are never to be filled up is God only to be found in the disorders of the world? Those who yield to the temptation to reserve a point here and there for

special divine interposition are apt to forget that this virtually excludes God from the rest of the process. If God appears periodically he disappears periodically. If he comes upon the scene at special crises he is absent from the scene in the intervals. Whether is all-God or occasional-God the nobler theory? Positively, the idea of an immanent God, which is the God of evolution, is infinitely grander than the occasional wonder-worker who is the God of an old theology. Negatively, the older view is not only the less worthy, but it is discredited by science. And as to facts, the daily miracle of a flower, the courses of the stars, the upholding and sustaining day by day of this great palpitating world, need a living will as much as the creation of atoms at the first. We know growth is the method by which things are made in nature, and we know no other method. We do not know that there are not other methods; but if there are we do not know them. Those cases which we do not know to be growths we do not know to be anything else, and we may at least suspect them to be growths. Nor are they any the less miraculous because they appear to us as growths. A miracle is not *something quick*. The doings of these things may seem to us no miracle; nevertheless it is a miracle that they have been done.

"But, after all, the miracle of evolution is not the process, but the product. Beside the wonder of the result the problem of the process is a mere curiosity of science. For what is the product? It is not mountain and valley, sky and sea, flower and star, this glorious and beautiful world in which man's body finds its home. It is not the godlike gift of mind nor the ordered and rational cosmos where it finds an exercise for its noblest powers. It is that which of all other things in the universe commends itself, with increasing sureness as time goes on, to the reason and to the heart of humanity—love. Love is the net result of evolution. This is what stands out in nature

as the supreme creation. Evolution is not progress in matter. Matter cannot progress. It is a progress in spirit, in that which is limitless, in that which is at once most human, most rational, and most divine. Whatever controversy rages as to the factors of evolution, whatever mystery enshrouds its steps, no doubt exists of its goal. The great landmarks we have passed—and we are not yet halfway up the ascent—each separately and all together have declared the course of nature to be a rational course and its end a moral end. At the furthest limit of time, in protoplasm itself, we saw start forth the two great currents which, by their action and reaction, as selfishness and unselfishness, were to supply in ever-accentuating clearness the conditions of the moral life. Following their movements upward through the organic kingdom we watched the results which each achieved—always high, and always waxing higher; and though what we called evil dogged each step with sinister and sometimes staggering malevolence, the balance, when struck, was always good upon the whole. Then came the last great act of the organic process, the act which finally revealed to teleology its hitherto obscured end, the organization of the mammalia, the kingdom of the mothers. So full of ethical possibility is this single creation that one might stake the character of evolution upon the mammalia alone. On the biological side, as we have seen, the evolution of the mammalia means the evolution of mothers; on the sociological side, the evolution of the family; and on the moral side, the evolution of love. How are we to characterize a process which ripened fruits like these? That the very animal kingdom had for its end and crown a class of animals who owe their name, their place, and their whole existence to altruism; that through these mothers society has been furnished with an institution for generating, concentrating, purifying, and redistributing love in all its enduring forms; that the perfecting of love is thus not an incident in nature, but

everywhere the largest part of her task, begun with the first beginnings of life, and continuously developing quantitatively and qualitatively to the close—all this has been read into nature by our own imaginings, or it is the revelation of a purpose of benevolence and a God whose name is Love. The skeptic, we are sometimes reminded, has presented crucial difficulties to the theist founded on the doctrine of evolution. Here is a problem which the theist may leave with the skeptic. That that which has emerged has the qualities it has, that even the mammalia should have emerged, that that class should stand related to the life of man in the way it does, that man has lived because he loved, and that he lives to love—these, on any theory but one, are insoluble problems.

"Forbidden to follow the evolution of love into the higher fields of history and society, we take courage to make a momentary exploration in a still lower field—a field so far beneath the plant and animal level that hitherto we have not dared to enter it. Is it conceivable that in inorganic nature, among the very material bases of the world, there should be anything to remind us of the coming of this tree of life? To expect even foreshadowings of ethical characters there were an anachronism too great for expression. Yet there is something there, something which is at least worth recalling in the present connection.

"The earliest condition in which science allows us to picture this globe is that of a fiery mass of nebulous matter. At the second stage it consists of countless myriads of similar atoms, roughly outlined into a ragged cloudball, glowing with heat and rotating in space with inconceivable velocity. By what means can this mass be broken up, or broken down, or made into a solid world? By two things—mutual attraction and chemical affinity. The moment when within this cloudball the conditions of cooling temperature are such that two atoms could combine together the cause of the evolution of the earth

is won. For this pair of atoms are chemically "stronger" than any of the atoms immediately surrounding them. Gradually, by attraction or affinity, the primitive pair of atoms—like the first pair of savages—absorb a third atom, and a fourth, and a fifth, until a 'family' of atoms is raised up which possesses properties and powers altogether new, and in virtue of which it holds within its grasp the conquest and servitude of all surrounding units. From this growing center attraction radiates on every side, until a larger aggregate, a family group—a tribe—arises and starts a more powerful center of its own. With every additional atom added, the power as well as the complexity of the combination increases. As the process goes on, after endless vicissitudes, repulsions, and readjustments, the changes become fewer and fewer, the conflict between mass and mass dies down, the elements passing through various stages of liquidity finally combine in the order of their affinities, arrange themselves in the order of their densities, and the solemn earth is finished.

"Now recall the names of the leading actors in this stupendous reformation. They are two in number, mutual attraction and chemical affinity. Notice these words—attraction, affinity. Notice that the great formative forces of physical evolution have psychical names. It is idle to discuss whether there is or can be any identity between the thing represented in the one case and in the other. Obviously there cannot be. Yet this does not exhaust the interest of the analogy. In reality, neither here nor anywhere have we any knowledge whatever of what is actually meant by attraction; nor, in the one sphere or in the other, have we even the means of approximating to such knowledge. To Newton himself the very conception of one atom or one mass, attracting through empty space another atom or another mass, put his mental powers to confusion. And as to the term affinity, the most recent chemistry, finding

it utterly unfathomable in itself, confines its research at present to the investigation of its modes of action. Science does not know, indeed, what forces are; it only classifies them. Here, as in every deep recess of physical nature, we are in the presence of that which is metaphysical, that which bars the way imperiously at every turn to a materialistic interpretation of the world. Yet, name and nature of force apart, what affinity even the grossest, what likeness even the most remote, could one have expected to trace between the gradual aggregation of units of matter in the condensation of a weltering star and the slow segregation of men in the organization of societies and nations? However different the agents, is there no suggestion that they are different stages of a uniform process, different epochs of one great historical enterprise, different results of a single evolutionary law?

"Read from the root, we define this age-long process by a word borrowed from the science of roots—a word from the clay—evolution. But read from the top, evolution is an impossible word to describe it. The word is involution. It is not a stigmaria world, but a sigillaria world; a spiritual, not a material, universe. Evolution is advolution; better, it is revelation—the phenomenal expression of the divine, the progressive realization of the ideal, the ascent of love. Evolution is a doctrine of unimaginable grandeur. That man should discern the prelude to his destiny in the voices of the stars; that the heart of nature should be a so human heart; that its eternal enterprise should be one with his ideals; that even in the universe beyond the reason which presides should have so strange a kinship with that measure of it which he calls his own; that he, an atom in that universe, should dare to feel himself at home within it, should stand beside immensity, infinity, eternity, unaffrighted and undismayed—these things bewilder man the more that they bewilder him so little.

"But one verdict is possible as to the practical import of this great doctrine, as to its bearing upon the individual life and the future of the race. Evolution has ushered a new hope into the world. The supreme message of science to this age is that all nature is on the side of the man who tries to rise. Evolution, development, progress are not only on her program, these are her program. For all things are rising, all worlds, all planets, all stars and suns. An ascending energy is in the universe, and the whole moves on with one mighty idea and anticipation. The aspiration in the human mind and heart is but the evolutionary tendency of the universe becoming conscious. Darwin's great discovery, or the discovery which he brought into prominence, is the same as Galileo's—that the world moves. The Italian prophet said it moves from west to east; the English philosopher said it moves from low to high. And this is the last and most splendid contribution of science to the faith of the world.

"The discovery of a second motion in the earth has come into the world of thought only in time to save it from despair. As in the days of Galileo, there are many even now who do not see that the world moves—men to whom the earth is but an endless plain, a prison fixed in a purposeless universe where untried prisoners await their unknown fate. It is not the monotony of life which destroys men, but its pointlessness; they can bear its weight, its meaninglessness crushes them. But the same great revolution that the discovery of the axial rotation of the earth effected in the realm of physics the announcement of the doctrine of evolution makes in the moral world. Already, even in these days of its dawn, a sudden and marvelous light has fallen upon earth and heaven. Evolution is less a doctrine than a light; it is a light revealing in the chaos of the past a perfect and growing order, giving meaning even to the confusion of the present, discovering through all

the deviousness around us the paths of progress, and flashing its rays already upon a coming goal. Men begin to see an undeviating ethical purpose in this material world, a tide that from eternity has never turned, making for perfectness. In that vast progression of nature, that vision of all things from the first of time moving from low to high, from incompleteness to completeness, from imperfection to perfection, the moral nature recognizes in all its height and depth the eternal claim upon itself. Wholeness, perfection, love—these have always been required of man. But never before on the natural plane have they been proclaimed by voices so commanding, or enforced by sanctions so great and rational.

"Is nature henceforth to become the ethical teacher of the world? Shall its aims become the guide, its spirit the inspiration of man's life? Is there no ground here where all the faiths and all the creeds may meet—nay, no ground for a final faith and a final creed? If all men could see the inner meaning and aspiration of the natural order should we not find at last a universal religion—a religion congruous with the whole past of man, at one with nature, and with a working creed which science could accept?

"The answer is a simple one: we have it already. There exists a religion which has anticipated all these requirements—a religion which has been before the world these eighteen hundred years, whose congruity with nature and with man stands the test at every point. Up to this time no word has been spoken to reconcile Christianity with evolution, or evolution with Christianity. And why? Because the two are one. What is evolution? A method of creation. What is its object? To make more perfect living beings. What is Christianity? A method of creation. What is its object? To make more perfect living beings. Through what does evolution work? Through love. Through what does Christianity

work? Through love. Evolution and Christianity have the same Author, the same end, the same spirit. There is no rivalry between these processes. Christianity struck into the evolutionary process with no noise or shock; it upset nothing of all that had been done; it took all the natural foundations precisely as it found them; it adopted man's body, mind, and soul at the exact level where organic evolution was at work upon them; it carried on the building by slow and gradual modifications; and, through processes governed by rational laws, it put the finishing touches to the ascent of man.

"No man can run up the natural lines of evolution without coming to Christianity at the top. One holds no brief to buttress Christianity in this way. But science has to deal with facts and with all facts, and the facts and processes which have received the name of Christian are the continuations of the scientific order, as much the successors of these facts and the continuations of these processes—due allowances being made for the differences in the planes, and for the new factors which appear with each new plane—as the facts and processes of biology are of those of the mineral world. We land here, not from choice, but from necessity. Christianity—it is not said any particular form of Christianity—but Christianity is the further evolution.

"'The glory of Christianity,' urged Jowett, 'is not to be as unlike other religions as possible, but to be their perfection and fulfillment.' The divinity of Christianity, it might be added, is not to be as unlike nature as possible, but to be its coronation; the fulfillment of its promise; the rallying point of its forces; the beginning, not of a new end, but of an infinite acceleration of the processes by which the end, eternal from the beginning, was henceforth to be realized. A religion which is love and a nature which is love can never but be one. The infinite exaltation in quality is what the progressive revela-

tion from the beginning has taught us to expect. Christianity, truly, has its own phenomena, its special processes, its factors altogether unique. But these do not excommunicate it from God's order. They are in line with all that has gone before, the latest disclosure of environment. Most strange to us and new, most miraculous and supernatural, when looked at from beneath, they are the normal phenomena of altitude, the revelation natural to the highest height. While evolution never deviates from its course it assumes new developments at every stage of the ascent; and here, as the last and highest, these specializations, accelerations, modifications, are most revolutionary of all. Christianity did not begin at the Christian era, it is as old as nature: did not drop like a bolt from eternity, came in the fullness of time. The attempt to prove an alibi for Christianity, to show that it was in the skies till the Christian era opened, is as fatal to its acceptance by science as it is useless for defense to theology. What emerges from nature as the final result of creation is the lower potentiality of the same principle which is the instrument and end of the new creation.

"The attempt of science, on the other hand, to hold itself aloof from the later phases of developments which in their earlier stages it so devotes itself to trace is either ignorance or affectation. For that altruism which we found struggling to express itself throughout the whole course of nature, what is it? 'Altruism is the new and very affected name for the old familiar things which we used to call charity, philanthropy, and love.'* Only by shutting its eyes can science evade the discovery of the roots of Christianity in every province that it enters; and when it does discover them, only by disguising words can it succeed in disowning the relationship. There is nothing unscientific in accepting that relationship; there is much that is unscientific in dishonoring it. The will behind

* Duke of Argyll, *Edinburgh Review*, April, 1894.

evolution is not dead; the heart of nature is not stilled. Love not only was; it is; it moves; it spreads. To ignore the later and most striking phases is to fail to see what the earlier process really was, and to leave the ancient task of evolution historically incomplete. That Christian development, social, moral, spiritual, which is going on around us, is as real an evolutionary movement as any that preceded it, and at least as capable of scientific expression. A system founded on self-sacrifice, whose fittest symbol is leaven, whose organic development has its natural analogy in the growth of a mustard tree, is not a foreign thing to the evolutionist; and that spokesman of the kingdom of God is no less the spokesman of nature when he proclaims that the end of man is 'that which we had from the beginning, that we *love*.'

"In the profoundest sense this is scientific doctrine. The ascent of man and of society is bound up henceforth with the conflict, the intensification, and the diffusion of the struggle for the life of others. This is the further evolution, the page of history that lies before us, the closing act of the drama of man. The struggle may be short or long; but by all scientific analogy the result is sure. All the other kingdoms of nature culminated; evolution always attains, always rounds off its work. It spent an eternity over the earth, but finished it. It struggled for millenniums to bring the vegetable kingdom up to the flowering plants, and succeeded. In the animal kingdom it never paused till it exhausted the possibilities of matter in the creation of the mammalia. Kindled even by this past, man may surely say, 'I shall arrive.' The further evolution must go on, the higher kingdom come—first the blade, where we are to-day; then the ear, where we shall be to-morrow; then the full corn in the ear, which awaits our children's children, and which we live to hasten."

These words are an antidote to any evils of many obscure

utterances in the preceding pages of his great book. Here evolution is simply God working in building and carrying forward the universe.

The argument for a higher antiquity than that of the scriptural Adam, and also in favor of a different type for the more primitive races, derived from the early and extreme differences known to exist, is the most potent proof as yet adduced. The elements of the argument are these: (*a*) Offspring resemble parents; this is a universal law in the realms of life. There are marginal variations, but the core and substance of the type is preserved. In the case of the human order features are transmitted as a rule, and color always. From white parents emanate white children. The black and brown races transmit their color to their offspring. (*b*) At the most remote time to which research carries us the white, black, and brown races were as distinctly differentiated as they now are, and neither has undergone any change of feature or color during historic time or for at least four thousand years. Two inferences are drawn, both of which are supposed to form the theory of diversity of origins. (*c*) Types which persist without variation for so long a period must be regarded as permanent. (*d*) It is unaccountable that such changes and variations should have taken place so early in race history, and no such changes be observable in equal time in later ages; it is probably stranger that the variety is original.

The argument based on the ethnic roots and dispersions of men includes the following elements taken from the Lowell Lectures given in Boston by Sir William Dawson, on "The Meeting Place of Geology and History." The last lecture was in the nature of a summary. Professor Dawson affirmed that the first chapter of Genesis corresponds with the facts revealed in geology, so far as a summary intended

for a religious rather than a scientific purpose could be supposed to anticipate the results of modern astronomy and geology. The rational mode of interpreting this first chapter was to regard the days as days of vision or days of God. The reference to the creation of man in the second chapter does not contradict that in the first, because this second account refers to a special locality. As to the duration of man and the doctrines of evolution, he said that the oldest known men are within the limit of variation of man in historic times, and geology has discovered no links of connection between him and the lower animals. In the present world man is not only specifically, but generically, and as a family, distinct from the nearest of the mammalia. Man's rational and moral nature and power of speech interpose a still stronger barrier. The science of the earth and history, both sacred and profane, are in harmony, so says Professor Dawson, on the following points: the recency of man as compared with the greater part of the animal creation; the early condition of man as frugiverous in a genial climate, and his speedy lapse into a state of savagery; the fact that man and his companion animals experienced a great continental submergence, and that men spread themselves over the earth anew; that all these events fall in the time between the close of the glacial period and the present day; that no evidence either in geology or history indicates that man existed previously; that no record suggests any other origin for man than a divine creative act; lastly, that man possessed from the first the same inventive and artistic powers, and the same belief in a future state and in a divine power which have characterized him at a later day.

I place along with the view of Dr. Winchell also a recent deliverance of Rudolph Virchow (address at the opening of the International Congress of Prehistoric Archæology and Anthropology at Moscow). He is acknowledged to stand at the head

of his class on these and kindred subjects. I give permanent form to the utterance by inserting it entire, as the last word on the subject from a scientific standpoint, and from the most eminent authority. He says:

"International prehistoric congresses have for a whole generation exercised a great influence upon the researches and the ideas of our contemporaries. This institution was founded at the time when the discoveries of Boucher de Perthes of the existence of man in the Drift period, the observations of Ferdinand Keller on pile constructions; those of Christi and Lartet on the troglodytes of the Dordogne, and of Vorso on the kitchen middens, and the theory of Darwin and his disciples were producing a revolution in scientific traditions. As a result of that revolution the congress found itself confronting a great problem. It was incumbent on it to study all the countries of Europe in order to collect prehistorical traces of man, to attract general attention to the origin and course of human civilization; and it proposed to itself to remove the veil of mystery from before the primitive cradle of man.

"Many of the questions which were raised at this time have now been definitively resolved. We know that man existed in the Quaternary epoch, that he lived through long ages miserable and depressed, while stone, wood, horn, and bone constituted the material of his arms and of his only instruments; we are convinced that a long interval separated the age of stone from the age of metals, and that only in particular places was the use of stone immediately replaced by that of metals. These are the data which now make part of the general knowledge acquired by civilized nations since the foundation of the congress. But further studies respecting the origin and the regions whence the different branches of civilization have sprung have advanced relatively but very little.

"First, the question of Tertiary man especially occupied the

congress, and reached its culminating point at the meeting in Lisbon. We were taken there to the plain of Otto to look in the strata for his remains. We found there flint chips that might in an extreme case be regarded as having been cut by man; but we discovered no human bones, or potteries, or worked objects, and the majority of the congress, on leaving the place, were far from being convinced that these flint chips were distinguished in any respect from the *débris* which is found in the ground everywhere, and which results from the disintegration of a siliceous soil. Nobody has ever found in virgin Tertiary strata any piece of flint that has been recognized by the learned world as an unquestionable relic of the existence of man. We have likewise reached the same result in our search for human skulls and bones. We have to recognize that students cannot assume that man existed in the Tertiary, or that there is any probability that the human race had its beginning in that epoch; on the contrary, we find a great void which we try to fill with fantastic imaginings, but which furnishes us with no real specimen.

"After the Congress of Lisbon students were more moderate, and confined themselves to the search for known objects. Among these objects archæological finds predominated, and it is easy to understand why archæology has more and more taken the place of anthropology. Palæanthropological objects are so rare, and for the most part so liable to suspicion, that even till the present time the attempt to describe the most ancient race of Quaternary men is beyond the power of science. We have had two examples in Europe that afforded little encouragement: the attempts based on the Canstadt and on the Neanderthal skulls, which, as two eminent students once supposed, belonged to the extinct aborigines of the primitive European race. We discussed the question raised over these two skulls fifteen years ago at the Congress of German Anthropologists

in Ulm, and found that the Canstadt skull did not belong to the Quaternary, while the Neanderthal skull was at least very far from having a typical form.

"I shall not examine the whole series of similar discoveries, most of which have only furnished us single exceptional skulls. But I must declare that even if these skulls had been what they were described as being, and their geological position had been exactly defined, they could not have constituted proof of the existence of an inferior primitive race that could be regarded as a step between animals and existing man. Many of these skulls appear to be very ancient; but they resemble in all respects the skulls of modern races, and some of them even those of civilized races. We seek in vain for the 'missing link' connecting man with the monkey or any other animal species.

"We must, however, understand ourselves on a preliminary question. There exists a tradition common to all peoples, or, we might say, a dogma common to all religions, recognized by all students, ancient and modern, that the human body has an animal organization; that the same physiological and pathological laws rule human and animal life alike. Notwithstanding this uniformity there exists a definite barrier separating man from the animal which has not yet been effaced—heredity, which transmits to children the faculties of their parents. We have never seen a monkey bring a man into the world, nor a man produce a monkey. All men having a simian appearance are simply pathological variants. The opinion of Carl Vogt, that microcephalous men, resembling simian animals, are produced by atavism, has been wholly abandoned since students have reached the conviction that the skulls of microcephals have indexes of pathological formation, with deficiencies arising from degeneracy.

"The human organism, especially in the embryonic stage, is distinguished by many features that have been borrowed, not

from the monkey only, but also from other animals. The living elements, the cells, present us the same types in man as in the mammals; sometimes these resemblances in the embryo continue to exist, and are even developed after birth. But this persistence or hyperplasy cannot be made to serve as proof of the animal origin of man. Let us take this example of a hyperplasy of this kind; there is in the higher anthropoid apes a bony ramification that connects the jugular of the temporal with the frontal bone. It is sometimes developed in man, and is wanting in some individuals among the higher monkeys. I have shown, and M. Anoutchine has confirmed it, that this ramification occurs very frequently in the Australians, and we both regard the peculiarity as of simian origin. But we cannot conclude from that that the Australians are simianlike, for the same peculiarity has been remarked, in some infrequent cases, in the skulls of Europeans; while there is not an example of men having such heads having furnished any other indication of simian organization or development. The bony ramification of the temporal jugular is nothing else than a special peculiarity, sometimes individual, sometimes racial, like curly hair, for example. When we look at a Negro's head we might say that it resembles a sheep or a poodle; but, so far as we know, nobody has yet expressed the opinion that the Negroes are descended from sheep or from dogs. Still, the Negroes are like sheep and poodle dogs in the hereditary transmission of a special peculiarity in their hair. In spite of that their heads in no way resemble those of the animals we have mentioned. Bearing in mind these observations, we have become more circumspect now in our reasonings upon individual or racial analogies between man and animals. We certainly shall not forget that the human organization is in its essentials an animal organism, and that the monstrosities which occasionally appear may be regarded as results of atavism; but we shall require more con-

vincing arguments before we assume a near relationship of man with any definite animal.

"It was generally believed a few years ago that there yet existed a few human races which still remained in the primitive inferior condition of their organization. But all these races have been objects of minute investigation, and we know that they have an organization like ours, often, indeed, superior to that of supposed higher races; thus, the Eskimo head and the head of the Tierra del Fuegians belong to the perfected types. Some races have the same skulls very small, of about the same volume as the microcephalous skulls; for example, the inhabitants of the Andaman Islands and the Veddahs of Ceylon have been regarded as microcephalic. A more exact study has, however, shown a difference between them and the real microcephalic races. The head of an Andaman Islander or of a Veddah is very regular, only all its parts are a little smaller than among men of the ordinary races. Nanicephalic heads (dwarf), as I called them, have none of those characteristic anomalies that distinguish really microcephalic heads.

"A single race, that of the Orang-Simaings and the Orang-Cekai of the peninsula of Malacca, still remains unstudied. The single traveler who has penetrated into the mountainous countries inhabited by them, the bold Russian, Miklukho Maklai, has ascertained that certain isolated individuals among Simaings are small and have curled hair. A new expedition has been sent into that country to study the anthropology of the Orang-Cekai, from which I have recently received a skull and a few locks of hair; the stock is really a black race with curly hair, the brachycephalous head of which is distinguished by very moderate interior volume, but it does not offer the most trifling sign of bestial development.

"Thus we are repulsed at every line of the assault upon the human question. All the researches undertaken with the aim

of finding continuity in progressive development have been without result. There exists no *proanthropos*, no man-monkey, and the 'connecting link' remains a phantom.

"Scientific anthropology begins with living races; and the first step in the construction of the doctrine of transformism will be the explanation of the way the human races have been formed, and of the means by which they have acquired their specific peculiarities while still preserving hereditary transmission. That is the future field of anthropological debate and investigation. But this field is outside of the limitations of our congress. It is easy at first sight to suppose a dolichocephalous skull to be transformed into a brachycephalous skull, but still nobody has ever observed the transformation of a dolichocephalous race into a brachycephalous one, or *vice versâ*, or of a Negro race into an Aryan race.

"Prehistoric anthropology should find methods of facilitating acquaintance with the types of ancient races and peoples and of making possible the discovery of them among living men. It might add to that, if the occasion should present itself, data respecting strange individual cases, by the aid of which it is impossible to form a continuous line or constitute a genealogical tree, but which should be kept in the scientific lumber room till the time when we can find the intermediate links that may unite them into a series.

"And now let us continue faithful to the glorious traditions which our great masters have bequeathed to us. The majority of the students whose names are inscribed in the preceding congresses were archæologists. Lartet and Vorso, Liche and Clericci, Ouvarov and Romer, and others, have shown us how we must work. To select an example, questions like that of the discovery of copper, and of its value as a medium of exchange, ought to be problems of the greatest interest to us." *

* Translated for the *Popular Science Monthly* from the *Revue Scientifique*.

So much has been said of the probable age of man by a recent class of writers that this discussion would seem to be incomplete were no reference made to that subject. In a treatise which proposes to deal with the facts of the universe it has a natural place.

It is probable that the question of pluralities of origin would scarcely have been raised but for the fact that the Scriptures seem to fix upon a date for the origin of the Adamic race which it is declared is irreconcilable with some discovered facts. The attempt is made to account for these facts by assuming a more ancient race of men, dating back many, many thousand years. Some who are anxious to adhere to the Mosaic account imagine that the difficulty is relieved by this possible fact. Others, prompted by the same desire, resort to the plea that the chronology is probably at fault by a few or several thousand years.

The antichristian camp discard the Mosaic account entirely. Some writers of eminence, on what they consider sufficient grounds, regard both the idea of unity and the idea of recency as utterly without support and in antagonism to the facts. They are bold and persistent both for plurality of origins and immense antiquity, and without doubt have created widespread distrust of the commonly and long-held popular view. They array a set of facts which they call conclusive, and which seem formidable.

It is no part of our purpose to defend Moses. The simple question with us is, What do the facts show? If they are strong enough to overcome the evidence which supports the Scripture account either as to the unity of the race or its recency the conclusion ought to be accepted, whatever the consequences. Nothing has a right to live which is disproved by facts. We are constrained to the view both of recency and unity not in the interest of long-established beliefs, or of what we have been accustomed to receive as an inspired history, but solely in

the interest of truth and from the conviction that no facts appear which militate against the idea of unity of origin for the race, or against the fact that man has been an inhabitant of the earth not a longer period than about eight thousand years—which probable flaws in the Mosaic chronology would allow. No one pretends that we have a perfectly exact chronology. This has been an admitted fact long before the recent outcry. It is no new discovery or invention to overcome difficulties. What needs to be done is to examine the subject with calmness and candor, and not take fright at a shadow. There has been no time for the last centuries when it has not been said that newly discovered facts were conclusive against the Bible; but not one of these conclusive facts has unsettled a single stone in its foundation, and without exception each in its turn has either turned out to be no fact or to have no such explanation as was predicted to be so disastrous, and in most cases has been found to be helpful to a better understanding merely of the sacred record.

That which has created doubt to the unreflecting man, who runs eagerly after novelty and joins in the wild following of self-adulating masters, has been the discovery that some opinions long regnant have been found to be in error, and the hasty and unwarranted assumption is that all old notions are equally erroneous, especially the unquestioned discovery that the old theory of the earth's age is contradicted by facts which compel acceptance has made way for a precipitate conclusion that the same is true of man's age. This alone was enough to start the avalanche. It was hastily inferred that the latter conclusion rested on the same ground of certainty and was concluded by the same general facts as the former; and some facts lying back in prehistoric times were made to do service in the interest of a new chronology. If the earth was a hundred million years old, what more natural than that man should

have been at least a million years or so? Of course it must be so. So the rout began.

We assert that there was never a more perfect *non sequitur* or a theory built on a more flimsy foundation.

Monumental remains of every kind, arts, implements of industry, languages, written and spoken, traditions, archaic *débris*, and geological deposits, all point in the same direction. The present condition of the human race is conclusive of its comparatively recent origin. Had man, with his inborn tendencies and wants, been long a denizen of the earth, there would not be wanting abundant proofs of it. There are no such proofs. Somewhere, probably within, certainly not beyond, eight thousand years, his advent must be dated, as the case now stands.

Most recent statements.

For the most recent statement and examination of the scientific bearings of the subject see Dawson's *Earth and Man*. Many astute and learned critics who have been eager to make out a case have exhausted and strained to the last degree all possible sources of argument without effect. The stone age, "paleolithic and acolithic," which promised so much, and the loudly proclaimed human fossils found imbedded in the soils of Europe, and the collections of human bones in the caves of Belgium and England, along with the bones of extinct races of animals and under deposits of various kinds, and the ruins of lake villages of Switzerland, and kitchen middens of Denmark, and the tumuli of Europe, Asia, America, and cromlechs and dolmens of various countries, and similar cases, all after utmost pressure fail to do service for a higher antiquity.

Archæological facts.

That man has left no sign of his existence on the earth more remote than the postglacial, or at the close of the postpliocene geological period, and, indeed, not until the recent quaternary, is the finding after long-continued and widely extended

examination of all possible sources of information. Geologist, archæologist, ethnologist, philologist, and critics in every department whose lore could be of any avail have searched in vain for proof.

Dr. Miley has written with such illumination on the subject that I give him in full:

"While scientists are agreed that man is the latest of living orders, and comparatively very recent, there is with them a wide range of opinion respecting the time of his origin. Many are agreed in assigning him a high antiquity. However, beyond this point of agreement the range is from a comparatively moderate reckoning, say 100,000 years, up to millions, and even hundreds of millions. Figures, however, are rarely given, but alleged facts are assumed to measure vast ages. Lyell thinks he can trace the signs of man's existence up to the postpliocene era, and anticipates the finding of his remains in the pliocene period.* Only an immense reach of time can carry us back to that period. Again, he thinks that the facts of geology 'point distinctly to the vast antiquity of paleolithic man.'† After a review of some of the evidences of man's antiquity Huxley puts the question of time thus: 'Where, then, must we look for primitive man? Was the oldest *Homo sapiens* pliocene or miocene, or yet more ancient?'‡ Without the 'yet more ancient' he had already gone back into the midst of the tertiary period. By so much does he transcend Lyell. On the truth of evolution Huxley is sure that 'we must extend by long epochs the most liberal estimate that has yet been made of the antiquity of man.' Sir John Lubbock is quite up with Lyell; indeed, we may say, quite up with Huxley. The relative facts of geology 'impress us with a vague and overpowering sense of antiquity.

* *Antiquity of Man*, p. 399. † *Principles of Geology*, vol. ii, p. 570.
‡ *Man's Place in Nature*, p. 184.

. . . But it may be doubted whether even geologists yet realize the great antiquity of our race.'* Lubbock believes in miocene man, but rather as an implication of evolution than from any discovered sign of his presence in that ancient geologic age.† Wallace is comparatively very moderate, but reaches out for a long time. 'We can with tolerable certainty affirm that man must have inhabited the earth a thousand centuries ago, but we cannot assert that he positively did not exist or that there is any good evidence against his having existed, for a period of ten thousand centuries.'‡ We have given a few instances. Many scientists of like views might be added to the list.

"The sources of evidence for a high antiquity of man are well defined, and appear with much uniformity in the fuller treatment of the question. However, the treatment is often partial, when the evidence from only a few sources, perhaps from only one, is adduced. This is the method of Huxley, who treats the question simply in view of fossil remains of man, particularly of fossil skulls.§ A summary of the sources of evidence in a comprehensive treatment is given by Southall,‖ and also by the Duke of Argyll.¶ These summaries, while varying in words, are much the same in their facts. The comprehensive discussions of the question by Sir Charles Lyell** and Sir John Lubbock†† are substantially in the method of these classifications.

"We may state the evidences of a high antiquity of man in the following order: 1. History, with special reference to the antiquity of nations. 2. Archæology, including many forms of fact which show the early presence and agency of man. 3. Geology, with special reference to drift deposits. 4. Language—the time necessary for its growth and multiplication

* Lubbock, *Prehistoric Times*, p. 419.
† *Ibid.*, p. 423.
‡ *On Natural Selection*, p. 303.
§ *Man's Place in Nature*, p. 140.
‖ *The Recent Origin of Man*, p. 86.
¶ *Primeval Man*, pp. 76–78.
** *Antiquity of Man.*
†† *Prehistoric Times.*

into so many forms. 5. The distinction of races in color and feature. Our brief review cannot fully adhere to this order.

"The evidence from history centers in the proof of an early existence of separate nations or kingdoms. Contemporary with the earliest history of Abraham, twenty centuries before the Christian era, Chaldea and Egypt appear as strong and flourishing kingdoms. Kings with separate realms are already numerous, mostly with small dominion, but some perhaps, as appeared a little later in the case of Chedorlaomer, king of Elam, with broad sway. So much may fairly be gathered from the Scriptures.* The evidence of history and archæology seems conclusive that in the time of Abraham Egypt was a strong kingdom, with a high form of civilization. Such a kingdom could not be the growth of a few years; and we may add an antecedent history of from five to seven centuries. Renouf would add many more,† but the number named will suffice. There were other kingdoms and civilizations, the Babylonian, Persian, Indian, and Chinese, of about the same antiquity. They also came into history about the time of Abraham, but, with Egypt, required previous centuries of growth. 'So far, then, we have the light of history shining with comparative clearness over a period of two thousand years before the Christian era. Beyond that we have a twilight tract of time which may be roughly estimated at seven hundred years—a period of time lying in the dawn of history, at the very beginning of which we can dimly see that there were already kings and princes on the earth.' ‡

"It thus appears that history, with its clear implications, carries the existence of distinct nations back to the time of the flood—as that time is usually reckoned. We have three alternatives: either a narrow limitation of the flood, or a plurality

* Gen. xi–xiv.

† *The Religion of Ancient Egypt*, lect. ii.

‡ Argyll, *Primeval Man*, p. 95.

of human origins, or an extension of our biblical chronology anterior to the call of Abraham. No sufficient limitation of the flood is permissible. If consistently with the Scriptures we might in this mode account for the existence of the distant nations of India and China, we could not so account for the equally early, rather earlier, nations in the regions of the Tigris and the Euphrates. These regions could not have escaped the flood. A plurality of human origins is contrary to the Scriptures and to the facts of science, and inconsistent with the deepest truths of Christian theology. The third alternative may be accepted without the slightest hesitation. There is no fixed chronology of the Scriptures before the time of Abraham. Hence there is nothing against the addition of all the time—say two or three thousand years—which the facts of human history may require.

"Many facts adduced in evidence of a high antiquity of man may be grouped under the heads of archæology and geology. In some classifications the two terms represent distinct sets of facts. The distinction, however, is but slight, and may be omitted in our brief discussion. Under these headings we have several classes of facts, and many particulars of each class—altogether too many for present notice. We may name as classes —megalithic structures and tumuli; lake dwellings; shell-mounds; peat bogs; bone caves; drift deposits. The point of the argument in each is that the remains of man and the products of his agency appear in conditions which prove his high antiquity.* This argument is fully elaborated by the authors named.

"We shall give a very brief reply in the words of an eminent scientist. 'The calculations of long time based on the gravels of the Somme, on the cone of the Tinière, on the peat bogs of

* Lubbock, *Prehistoric Times;* Lyell, *Antiquity of Man;* Jeffries, *Natural History of the Human Races;* Quatrefages, *The Human Species*, pp. 129–153.

France and Denmark, on certain cavern deposits, have all been shown to be more or less at fault; and possibly none of these reach further back than six or seven thousand years which, according to Dr. Andrews,* have elapsed since the close of the bowlder clay deposits in America. . . . Let us look at a few facts. Much use has been made of the "cone" or delta of the Tinière, on the eastern side of the Lake of Geneva, as an illustration of the duration of the modern period. This little stream has deposited at its mouth a mass of *débris* carried down from the hills. This, being cut through by a railway, is found to contain Roman remains to a depth of four feet, bronze implements to a depth of ten feet, stone implements to a depth of nineteen feet. The deposit ceased about three hundred years ago, and, calculating 1,300 to 1,500 years for the Roman period, we should have 7,000 to 10,000 years as the age of the cone. But before the formation of the present cone another had been formed twelve times as large. Thus for the two cones together a duration of more than 90,000 years is claimed. It appears, however, that this calculation has been made irrespective of two essential elements in the question. No allowance has been made for the fact that the inner layers of a cone are necessarily smaller than the outer; nor for the further fact that the older cone belongs to a distinct time (the pluvial age already referred to), when the rainfall was much larger and the transporting power of the torrent greater in proportion. Making allowance for these conditions, the age of the newer cone, that holding human remains, falls between 4,000 and 5,000 years. The peat bed of Abbeville, in the north of France, has grown at the rate of one and a half or two inches in a century. Being twenty-six feet in thickness the time occupied in its growth must have amounted to 20,000 years; and yet it is probably newer than some of the gravels on the same river containing flint imple-

* *Transactions*, Chicago Academy, 1871.

ments. But the composition of the Abbeville peat shows that it is a forest peat, and the erect stems preserved in it prove that in the first instance it must have grown at the rate of about three feet in a century, and after the destruction of the forest its rate of increase down to the present time diminished rapidly almost to nothing. Its age is thus reduced to perhaps less than 4,000 years. In 1865 I had an opportunity to examine the now celebrated gravels of St. Acheul, on the Somme, by some supposed to go back to a very ancient period. With the papers of Prestwick and other able observers in my hand, I could conclude merely that the undisturbed gravels were older than the Roman period, but how much older only detailed topographical surveys could prove; and that taking into account the probabilities of a different level of the land, a wooded condition of the country, a greater rainfall, and a glacial filling of the Somme valley with clay and stones subsequently cut out by running water, the gravels could scarcely be older than the Abbeville peat. . . . Taylor * and Andrews † have, however, I think, subsequently shown that my impressions were correct.

" 'In like manner I fail to perceive—and I think all American geologists acquainted with the prehistoric monuments of the western continent must agree with me—any evidence of great antiquity in the caves of Belgium and England, the kitchen middens of Denmark, the rock shelters of France, the lake habitations of Switzerland. At the same time I would disclaim all attempt to resolve their dates into precise terms of years. I may merely add that the elaborate and careful observations of Dr. Andrews on the raised beaches of Lake Michigan—observations of a much more precise character than any which, in so far as I know, have been made of such deposits in Europe—enable him to calculate the time which has elapsed since North

* *Journal of Geological Society*, vol. xxv. † *Silliman's Journal*, 1868.

America rose out of the waters of the glacial period as between 5,500 and 7,500 years. This fixes at least the possible duration of the human period in North America, though I believe there are other lines of evidence which would reduce the residence of man in America to a much shorter time. Longer periods have, it is true, been deduced from the delta of the Mississippi and the gorge of Niagara; but the deposits of the former have been found by Hilgard to be in great part marine, and the excavation of the latter began at a period probably long anterior to the advent of man.'*

"In this brief survey instances of the several classes of archæological and geological facts adduced in proof of a high antiquity of man are reviewed. Among them are instances regarded as most decisive of the question. The criticism of Dawson at least places their conclusiveness in uncertainty; and if it is not proved beyond question that the time of man's presence in the world must be limited to from 8,000 to 10,000 years, neither is it proved that his time is greater. In his elaborate discussion of this question Southall reviews all these instances, and finds them inconclusive of a high antiquity of man.† Such, likewise, is the conclusion of Winchell from the same facts.‡

"The argument from the growth of language is far less in use than others. Argyll distinctly names it in his classification, as previously given by reference, but the use he makes of it is rather to prove the unity than the antiquity of man. He points out the now familiar fact that comparative philology furnishes a law by which widely diverse races may be traced back to a common ethnic unity.§ There is still an indirect argument for the high antiquity of man. With the unity of the

* Dawson, *Story of the Earth and Man*, pp. 292–296.
† *The Recent Origin of Man.* ‡ *Preadamites*, pp. 421–426.
§ *Primeval Man*, pp. 109–112.

race through a common parentage there was originally but one language. Hence there must be time in the existence of the race for the formation of this original language, and of all the languages in the use of man.

"The doctrine of evolution requires a brutal character of primitive man, with the merest rudiment of that rationality which came with his higher development. Such a man might well be accounted speechless; and the creation of a language would indeed require a long time. But the evidence of such a brutal character of primitive man is still wanting. The facts in the case refuse to satisfy the exigency of the doctrine.

"There is nothing in science to discredit the Mosaic account of man's origin. In the sense of this account he was created in the maturity of manhood and in respect to his whole nature. A mature body and an infantile mind would have made him a monstrosity, with the slightest chance of survival. His mind was created in the same maturity as his body, and with mental powers as ready for normal action as the physical. It is also entirely consistent with this account—indeed, we think it a rational requirement—that primitive man was supernaturally aided in his mental acquirements. He did not have to wait upon the slow process of experience, but by divine inspiration came quickly to a knowledge of nature and language. In this rational view the original acquisition of language required no measure of time which must push back the origin of man into a high antiquity.

"The immediate offspring of Adam acquired language in the same manner as children of the present day, and in as brief a time. Such continued to be the law through all the antediluvian centuries. Under the same law the postdiluvian race started anew. Language was already a possession, and continued to be a transmission from generation to generation. In all divisions into separate communities each division went out

with a language. Hence the multiplication of languages was by variation, not by origination. There are no facts in the history of the race which require the pure originality of more than one. Comparative philology clearly traces many widely variant languages back to a few sources, and might reach a common source of all did not the marks of an ultimate unity become invisible in the dimness of antiquity. It thus appears that the assumption of a vast extent of time as necessary to the successive originations of many languages is utterly groundless.

"Languages, however, are very many, and there must have been time in the existence of the race for their formation. But in estimating the necessary time we must not overlook the distinction between origination and variation. In the former case we assume a speechless community in an infantile mental state. With such facts the necessary time could hardly be measured. Even the possibility of a purely human creation of language in such a state is not yet a closed question. In the other view, which accords with Scripture and is without the opposition of scientific facts, language was a speedy acquisition through a divine inspiration, with such mental development as must go with the knowledge and use of language. All were thus early in the possession of rational speech. Henceforth the formation of new languages was by variation. This is often a rapid process, as the facts of history prove. There are exceptional cases. With a common education, a common literature, and a free intercourse in the use of a common speech, there may be little change through long periods of time. It is not under such conditions that languages have been multiplied. It is when a larger community, with a common language, separates into distinct communities, and each begins a new life under changed conditions, that through a process of variation the one language is soon multiplied into as many as these separate communities.

"The facts of history show that this process is often a rapid one. No long age is required for the formation of a new language. The formation of many may proceed at once. The relative facts are sufficiently presented by Lyell,* and also by Southall.† It is worthy of note that the two are in substantial agreement respecting these facts, though the former maintains a high antiquity of man, and the latter a recent origin. The material point in which they agree, and which the facts verify, is that under changed conditions new languages are rapidly formed. Thus on the breaking up of the Roman empire and the distribution of the people into separate nationalities their common language was soon transformed into the Romance—such as the French, Italian, Spanish, and Portuguese. These languages, now spoken by so many peoples, are not a thousand years old, and only the fraction of a thousand was required for their formation. This is simply one instance out of many given by the authors named.

"This rapid formation of new languages is the material fact of the question. It is the conclusion of Southall that of some five thousand languages now spoken only a half-dozen are a thousand years old. If such is the work of ten centuries the formation of languages requires no stretch of time conclusive of a high antiquity of man.

"Another argument is based on the distinction of races. It does not require a detail of all the facts open to its use, but may be given in its full strength on such general distinctions of race as the Caucasian, Mongolian, and Negro. The argument is in two alleged facts: first, that such distinctions appear with the dawn of history; second, that only a very long time could have produced them. Greater apparent strength must be conceded to this argument on the theory of a unity of the

**Antiquity of Man*, chap. xxiii.
† *Recent Origin of Man*, pp. 25–30.

human race. With a plurality of origins such distinctions might have existed from the beginning, and no time would be required for their origination, while with the unity of the race the necessary time must be conceded. The early date of such distinctions cannot be disputed. For instance, the Negro, with his clearly marked characteristics, appears in Egyptian archæology fifteen or twenty centuries before the Christian era. It must be agreed that many other facts are adduced which prove the first part of the argument—a very early appearance of race distinctions.*

"The second part, that only long ages could produce such variations, is disputed. Many facts in natural history prove the contrary. Fortunately, such facts have fallen within historic times, particularly in the settlement of America, where the process of change could be more accurately measured. 'In the domesticated races of animals, and the cultivated tribes of plants, the phenomena of variation have been most remarkably displayed.'† Dr. Prichard cites many instances which illustrate and verify his position. The discussion runs through many pages.‡ The force of these facts is not affected by their limitation to domesticated animals and cultivated plants. The domestication and cultivation merely furnish the new conditions under which these changes naturally arise. Further, such instances are more readily open to observation; and their selection is for this reason, and not because they exemplify any peculiar susceptibility to change.

"It is a rational inference, and one supported by the strongest analogies, that under new conditions man is subject to like change, and in many respects, as the new conditions may greatly vary. 'Races of men are subjected more than almost

* Lyell, *Antiquity of Man*, pp. 385, 386; Lubbock, *Prehistoric Times*, pp. 587, 588; Argyll, *Primeval Man*, pp. 97–102; Winchell, *Preadamites*, chap. xiii.

† Prichard, *Natural History of Man*, p. 27. ‡ *Ibid.*, pp. 26–59.

any race of animals to the varied agencies of climate. Civilization produces even greater changes in their condition than does domestication in the inferior tribes. We may therefore expect to find fully as great diversities in the races of men as in any of the domesticated breeds. The influence of the mind must be more extensive and powerful in its operations upon human beings than upon brutes. And this difference transcends all analogy or comparison.' *

"Nor could the conditions of physiological variation be wanting in the earlier state of man. As the race multiplied broader territories would be required for its occupancy. Besides, the natural disposition of many would anticipate this exigency and push them out into new and distant regions. It appears, accordingly, in the beginning of history, and back of this in the relative facts of archæology, that at a very early day men occupied extensive reaches of territory. With this wide distribution there were great changes of climate and new habits of life. Thus at a very early day there were all the new conditions necessary to the variations which appear in the distinctions of race.

"Physiological changes have occurred in historic times and in comparatively brief periods.† There are many such instances. They do not equal some of the deeper race distinctions, but, with the brevity of their own period, are sufficient to discredit the assumption of vast ages as necessary to such variations. Hence we need no vast time to account for the distinctions of race which appear in the early history of man. A permissible extension of biblical chronology to eight or ten thousand years will suffice for the whole account."

* Prichard, *Natural History of Man*, p. 75.

† Southall, *Recent Origin of Man*, pp. 26–28.

ALL HUMAN BEINGS FROM ONE PAIR.

Did all men spring from one pair?

Is there reason to believe that all human beings have sprung from one original pair? This question has been answered affirmatively and negatively by men of equally eminent ability and learning. There can be no doubt that three potent influences have entered into the discussion, which have been unfavorable to a perfectly fair and unbiased judgment: (*a*) On the one side, extreme caste prejudice, which renders it impossible, almost, for branches of the family that have been highly civilized and improved in mental and physical condition to look upon less favored races as of the same origin with themselves; this, together with repugnance springing from difference of color, has created a bias to the negative so strong as to be almost irresistible. It is hard for the proud Caucasian to believe that the despised African or inferior Mongolian claims the same parentage with himself—that the same blood courses beneath a tawny or black skin which reddens in his self-assumed more aristocratic veins. Nothing is easier than to magnify the differences and awaken a feeling in the presence of which reason is impotent. (*b*) To this must be added, on the part of many, an unadmitted but real desire to make argument against the Bible and Christianity. Bad as the motive is, there have been and are famous men who would accept any theory which would throw doubt on these. Whatever is supposed to be unfriendly to them is seized with eagerness and pressed to the extreme. (*c*) On the other side, it must be admitted, is the not less potent influence of strong and unreasoning fear and repugnance of anything that threatens faith or weakens the hold of beliefs venerable and sacred.

Influences hindering a fair examination.

To reach a perfectly fair conclusion in the midst of such confusing embarrassments is difficult in the extreme. Both sides in the controversy are at disadvantage; truth is the sufferer. Withal, could the subject be approached with perfect candor, and were there no interested prejudices, or pride of opinion, or biases of any kind, the case would still be encompassed with difficulty—a *vexata quæstio.*

In favor of the negative are: (*a*) difference of color; (*b*) difference of cranial structure; (*c*) slight differences of anatomy; (*d*) difference of cuticle; (*e*) difference of odor; (*f*) difference of hair; (*g*) facial contour, noticeably the nose, lips, and prognathous jaws of the African; (*h*) mental tone and quality. These natural peculiarities have been urged with strained insistence and have been exaggerated into high significance. **Against unity.**

In rebuttal it has been shown that there are marginal varieties which are perfectly consistent with unity, and which to some extent find parallels, in well-known instances, in the same family, and all of which might arise under long-continued dissimilarities of climatic conditions, social and personal habits, exposures, food, and agencies of physical culture. The effects of these causes are admitted by all to be noticeable and great, and the only point of dispute is whether the causes are adequate to the extreme differences or adequate in the time human life has existed. In the absence of any bias it is probable they would not have the greatest, or at any rate deciding, weight. Any importance they appear to have arises mainly from the reinforcements of prejudice, from a tendency to hasty judgment on appearances, and from want of information; but these, with many, are more potent than the most convincing argument.

In favor of the affirmative are: (*a*) the fundamental similar-

ity of all races of men in every mental and physical characteristic; (*b*) under suitable environments the strong instinctive race affinities which always denote unity; (*c*) the absence of the universal law of hybridity fencing off species; (*d*) common heirlooms, discoverable in the traditions of the most widely separated nations; (*e*) common lingual roots; (*f*) common moral hereditaments of wants and helps; (*g*) common instincts and aspirations and outcomes under favorable conditions; (*h*) the deep-seated and ineradicable feeling of the common fatherhood of one God; (*i*) the historical proof, enabling us to trace the human family to one original center, from which they have migrated over the surfaces of the world; (*j*) the testimony of God in his own revelation; (*k*) similar variations in all animal species. The next to the last named will be ruled out by some, but by others, and on grounds of reason, it will be the most influential consideration of all. It must be admitted, however, that a seemingly strong argument is made from the Bible itself in support of the theory that other races of men were existing when Adam appeared.

In favor of unity.

Guizot says: "There can be but two explanations of man's origin: either he has been produced by the proper and innate labor of the natural forces of matter or he is the work of a supernatural power—external to, and superior to, matter. His appearance here below requires one of two causes, spontaneous generation or creation." He argues that as the earth could not of itself originate man and woman—the human pair and entirely formed and full grown—the only other supposition is, apart from supernatural influence, that they were originated by spontaneous generation. It is only under such a condition that man could have lived or perpetuated himself and have founded the human race. "Let us figure to ourselves," he says, "the first born man in early infancy, living, but inert, unintelligent,

helpless, incapable of supplying his own wants, trembling and moaning, with no mother to heal or nourish him." Rejecting this supposition, he insists that the other origin of the human race is alone admissible, and that man's first appearance in this lower world can be explained only by the supernatural fact of creation. The alternative of evolution from some lower type presents an escape from this conclusion; but as that is untenable we think the conclusion fair and irresistible.

Was Adam the first man?

Is there reason to believe that the Adam of revelation is the true original progenitor of the race? This question differs from the question of the unity of the race in this respect, that it is simply the question, *Who* was the original root? not, *Was there one original root?*

Arising out of the perplexities of the case, it has been imagined that the true *primus homo* might be pushed further back, and the real difficulties be thus met by lengthening the line and gaining larger views, bringing thus antiquity to explain variety.

McCausland.

McCausland, so far as I know, was the inventor of the ingenious theory that the Adam of the Bible was not the first man, but a higher type of man—an improvement. He is bold enough to assume in effect that the race had long existed when he was created, but that he was the first to receive moral or properly spiritual endowments; that he was in this respect a new and more complete man and the proper head of a new race, from whom descended a spiritual seed, by whom the descendants of the older and unspiritual stock were to be trained into moral and spiritual conditions. His seed were to be missionaries to the less favored but more ancient branches of the family. According to his view the Adam race was a true creation, not a descendant from a more

ancient stock. With him commenced the true moral and more intellectual race. He places his advent far along the line.

I find in a footnote that he credits the suggestion of his theory to "Peyroux de la Cordonière," of whom he says, "He appears to have been the first to promulgate the theory that the white race alone is physically active and possesses by nature the peculiar desire of knowledge which Aristotle ascribes to man generically; and consequently all higher culture of other races can only be explained by its being communicated to them by the white race. He found many disciples, among whom, in Germany, we would mention Klemm and Wuttke, who assume permanent differences between active and passive human races."

Three creations of man.

He (McCausland) seems to advocate at least three distinct creations of men, of whom Adam was the last and only complete man. His theory is not one of evolution from lower races. He sums up thus: "Thus all the evidences that are available on the subject—geological, archæological, philological, physiological, and historical—tend to establish the proposition that of the three apparently distinct races of mankind which are now, and have been from time immemorial, inhabitants of their respective sections of the earth's surface, the Caucasian was the last to make his appearance. The varieties have not, as generally assumed, been produced by the degradation of the higher to the lower, but by the advance from the lower to the higher, not by procreation but by successive creations. Their anatomical diversities, the vocabularies and structure of their languages, the analogies of the previous animal creations, and the phenomena of the cerebral and fœtal development of man, all testify to this upward procession of human life. There is no evidence to the contrary except the supposed authority of the Scriptures; and this, we shall presently show, instead of warranting, forbids the conclusion that the ear-

liest human inhabitants of the earth were of the highest type of organization. If the Mongol and Negro were inhabitants of the earth ages before the appearance of the first of the Caucasians—the Negro wholly uncivilized and incapable of self-civilization, and the Mongol either in the same position or, if semicivilized, as at the present day, wholly incompetent and powerless to advance either himself or others to a higher position—under such circumstances the introduction of the Caucasian race, with their superior mental and physical endowments and the natural capacity which they have evinced, even in their fallen state, for the extension of civilization and the enlargement and application of useful knowledge, inaugurates a new and important era in the history of the world. From the cradle of their birth they have poured forth their tribes into all lands throughout the garden of the globe lying between the inhospitable regions of central and northern Asia and the burning plains of equatorial Africa, extending or absorbing in progressing improvement the aboriginal inhabitants, and even stretching out their arms to grasp and appropriate all the other countries of the world to fill them with Caucasians and Caucasian institutions. "They stand before us," as Max Müller eloquently describes them, "as the prominent actors in the great drama of history, and have carried to their fullest growth all the elements of active life with which our nature is endowed. They have perfected society and morals, and we learn from their literature and works of art the elements of science, the laws of art, and the principles of philosophy.

"Here was a work worthy of the Creator. To introduce missionaries endowed with a knowledge of himself, and with civilizing instincts, to a dark and stagnant world, was consistent with his progressing power and providence, as shown forth in all his works from the beginning. It is a work which has never been suspended since the first Caucasians

The Caucasian a missionary race.

tilled the ground and pastured their flocks to the eastward of Eden, and which has been multiplying as it advanced. Ever encroaching on the territories of the inferior races, and seldom receding but to gather fresh strength, the apparent destiny of the Caucasian is to efface and absorb them all."

This eloquent summing up of his conclusion is followed by an argument in favor of his position drawn from the Scriptures. To the unique suggestion that though Adam was the first of a superior race he might have been the natural bonr progeny of some preadamite parents, and have transmitted to his lineal descendants the peculiar characteristics of a new variety of the human family which have survived the intervening generations to the present day, he says: "This is a question which philosophy is powerless to decide, and if Scripture is to pronounce we cannot avoid the conclusion that he was brought into existence without father or mother or descent, by an act of creation."

The argument throughout is exceedingly ingenious and conducted with great ability and a reverent spirit. It avoids the theory of evolution, but introduces two links in the ever-advancing chain of biological phenomena in the two types of man which preceded the Caucasian, in which there is found fundamental physical similarity, but also fundamental spiritual difference from the final type, thus bridging the chasm between the human and highest form of animal life. It accounts for all the facts of diversity in the human type as they have been and are found, and also for all the archæological facts, by retrogressing the line back of the Caucasian indefinitely.

Dr. Winchell in his recent work, *Preadamites*, takes substantially the same ground, but with favor to the theory of evolution. His discussion is conducted with great learning and ability and general fairness, but with some faults of too broad and unwarranted generalizations, as it appears to us, and inordinate methods, denoting a debater rather than a calm and

dispassionate inquirer. The argument is pressed to the utmost, and at points betrays the weakness which always results from overstraining. But with these drawbacks it is a great and worthy discussion; and while we cannot agree with his conclusions, we are free to confess that we are not prepared to say that they are certainly not true. He declares that he had not seen or read McCausland's book when his was prepared, and hence their substantial agreement is the more marked and significant. We accept the two as noble efforts of sincere and able minds struggling after the truth, and regard them as valuable contributions to the thought of the world. They should be not simply read, but carefully examined. It would be aside from our line to go at length into the argument, but for reasons which seem adequate we cannot accept the conclusions which they reach.

Possible preadamites.

There may be preadamites; these great authors may have found the clew to the unraveling of the perplexed question; but we must for the present adhere to the old-fashioned idea that the human race sprang from one human pair, and that the Adam of revelation is the *primus homo*. We are not able to believe that there are facts which make it necessary to accept of evolution against the abundant proof to the contrary, nor yet that there is a necessity to posit more than one creation for man or one back of Adam. Ten thousand years, or even five, is a vast period in human history, though hardly appreciable in life history. It is probable that we have become so accustomed to think and speak in terms of vast time in connection with the past of the earth and life upon it that we scarcely think five thousand years anything or sufficient to account for anything any more. This is doubtless a great mistake.

Ten thousand years adequate.

Let us ponder some instructive or suggestive facts. Our continent is but about four hundred years known to civilized

man. Who dare say that there is evidence of any human history upon it, prior to that, that needed more thousands of years than that to account for them? It is easy to assume it; but what is the proof. History (authentic), except in the one book that we are so reluctant to have testify, extends to less than three thousand years. All human achievement in art and learning of every kind worth naming falls within that period. Who dare say that three thousand more are not sufficient to account for the few fragments of the stone age that remain? We have great confidence in the science of geology as to its main facts—the infinite time, almost, of earth history which it unrolls, the vast ages of life and the organic changes which it records—but can we forget that it is only in its most recent records that we find any token of man in the changeable deposits of its superficial crust? The facts are few and confused that imply remote time, and the chances of invertive and disturbed position and erratic agency are too great upon such sparse data to base much certainty.

Ethnic varieties at the extremes are great and require time, but with all the agencies in both directions pushing extremes asunder, several thousand years could accomplish wonders. See where they would carry us. Three or four hundred years carry us to a time within which *all authentic American history* has transpired; and it is conceded that the ancient civilizations of the continent do not probably reach to more than a thousand years. Three thousand years carry us to the mythical age of Great Britain, behind which there is nothing; three thousand years all Europe is in the night of prehistoric time, and long-dead nations have not yet been born or are but in their mythic period. Egypt and the East carry us a little further, but soon all disappears. Can it be that so much has been done and experienced in that period, and must we have a much greater period forthe few facts

which we find remaining, which denote a remote age? The Assyrian and Egyptian ruins comprise archæological facts, all except a few rude constructions revealing only barbaric tastes and savage conditions that must carry us to near the beginning. It seems to us that more time is demanded than is needed for any known or inferable facts. It will be safe, to say the least, to wait until something more convincing is brought to our notice. Meantime there is too much argument and proof in support of the theory to warrant the closing of the door to further and perfectly free inquiry. The argument of Dr. Winchell can only be silenced by being answered, and, whatever the outcome may be, he must be credited not simply with courage, but with having made a putting of the case not to be overcome with slurs or appeals to prejudice. We are not able to furnish the answer; this we are frank to admit. Throughout reverence for the Bible, which, we doubt not, he as devoutly honors as any who differ with him, is apparent, and with a just appreciation of the bearings of the controversy he shows, we think, that his view has no necessary collision with the sacred book in its main features.

Dr. Winchell's theory of a more ancient type of man than the prehistoric man of Europe demands careful examination. He admits that there are no monumental evidences and no geological facts known which necessarily carry up the prehistoric man of Europe to more than from seven to ten thousand years, certainly within the postglacial age. He believes, however, that there are facts which point probably to a much higher antiquity for man. His theory is that the biblical Adam is not the head man of the race, but only the head man of the Hebrew race and those branches of the human family that are traced to that common root. He makes them the white race, and points out some biblical facts to justify his conclusion that there as already existing a numerous race, or races, of men when Adam was

introduced. He infers that the races existing when Adam appeared were the tawny and black races, and hence that they are not his descendants, but if related to him at all are more ancient and ancestral—the white race descendant of the black race, or if not, subsequent in origin. Let us examine the grounds of this theory, and, to do the subject justice, let us as much as possible free ourselves from passion and presuppositions of every kind.

From the alleged facts in the case and the well-known method of the divine movement, a method of increasing perfection in his works, it is posited that the first men were an inferior type of men, standing greatly above, but nearer to, the brute orders—a type incapable of high civilization or great spiritual development. It is supposed that there were several of these races, perhaps created at different periods and different centers, as the aboriginal Australians, Hottentots, Africans, Mongolians, each an improvement on the other, and existing many thousands of years, reaching back into the depths of geological ages, and overspreading large portions of the earth before the white race of a greatly superior type was introduced. These races never became developed men, never acquired anything beyond the rudest arts, never built or could build a civilization, perhaps were below the possibility of religious ideas. The only memorials they have left are the rude stone implements which are found, it is asserted, in the tertiary deposits. They roamed over the earth without habitations, dwelling in the caves and forests. Their only arts were the shaping out of flint and bone implements of war and instruments for capturing, slaying, and preparing their food. They perish before the progress of the higher race, or by their help become elevated into the rank and condition of civilized men. The opinion has been ventured that, as they were incapable of originating a civilization, so probably they were incapable of religion, and possibly were not immor-

tal or destined to a future existence. The introduction of the white race brought civilization, religion, and immortality. These races filled the gap between the highest human type and the most elevated of the brute orders, and show the regular march of events without a break from the lowest to the highest types of life.

It is insisted that there is nothing in the theory inconsistent with either the purest Christian sentiment or the teachings of their holy writings, which Christians revere as a revelation, and whether or not some such theory is necessary to meet the facts which are known to exist, and which must be accounted for, is the only question.

The first argument adduced in favor of the theory is from the Scriptures. If the Scriptures can be shown by implication to favor the theory, it will be of service on two accounts: (*a*) It will relieve the objection that it is antibiblical. This is important, for while it is true that a fact stands on its own proofs, irrespective of what the Bible may say, yet the Bible is so firmly intrenched in faith and evidence that it is a divine revelation that no fact can be established which is opposed to its testimony without evidence amounting to demonstration. (*b*) Its support as a revelation would itself be conclusive. It is wise, therefore, to begin the proof of the theory by putting the objection out of the way that the Scriptures are opposed to it; more wise still, if possible, to show that it has support from them.

The universal impression has been that the Bible is explicit in the affirmation that Adam was the first human being created, and so that he was the actual head of the race, from whom has sprung every other human being. This impression is not, however, more universal than was the impression that the world was created in six natural days about six thousand years ago,

based also on what seemed to be an explicit declaration. That has been compelled to yield to the force of counter evidence, and better learning has shown that the common impression rested upon unsound interpretation. A conviction equally strong as that which supports the Adamic headship of the race gave way before proof to the contrary, and has well-nigh entirely disappeared from the world. No well-informed person now entertains it. Universal impression and most profound conviction are neither proof of the soundness of interpretation nor the certainty of the truth of what is believed. Both may be compelled to give way.

Can it be shown that the universal faith in this instance is the result of misinterpretation or hasty generalization? And after all does the Bible teach just the opposite of what has been supposed?

The first proof offered in support of the theory is that the account itself does not imply that Adam was the first man; on the contrary, it is simply an account of the creation of the *man Adam* and a history of his descendants; that it does not even purport to be anything else.

The second ground of inference is found in the implications of the story of Cain. The elements are these: It seems from the face of the narrative that (*a*) Cain was the first son of Adam; (*b*) Abel seems to be the second born; (*c*) the murder of Abel seems to have taken place when they had just emerged into manhood; (*d*) when the murder took place, it would seem that the only human beings on the earth of the Adam stock were Adam and Eve and the children born of them subsequent to the birth of Cain, which, allowing that he had just attained his manhood, could at most consist of not more than a half score of children, boys and girls. These are the

apparent facts. But, allowing that there were really no other human beings than those composing this family, it is thought to be difficult to explain what immediately follows in the narrative. First, the apparent terror which developed in the mind of Cain, and, second, the expressed ground of it. "And Cain said unto the Lord, My punishment is greater than I can bear. Behold, thou hast driven me out this day from the face of the earth; and from thy face shall I be hid; and I shall be a fugitive and a vagabond in the earth; and it shall come to pass, that every one that findeth me shall slay me. And the Lord said unto him, Therefore whosoever slayeth Cain, vengeance shall be taken on him sevenfold. And the Lord set a mark upon Cain, lest any finding him should kill him. And Cain went out from the presence of the Lord, and dwelt in the land of Nod, on the east of Eden. And Cain knew his wife; and she conceived, and bare Enoch: and he builded a city" (Gen. iv, 13–17). The assumed and what, it must be confessed, seem to be the real difficulties of the passage, are these: (*a*) Cain's apprehension of danger from men; (*b*) the seeming implication that men were numerous and scattered abroad over the land to which he was banished; (*c*) the implication that they were strangers to Cain in the fact that a mark was put upon Cain by which he could be known, which would be wholly unnecessary if all the men that were on the earth were his own brothers; (*d*) it is inferred from the language of the narrative that he married a wife in the land to which he fled and of the people to whom he joined himself; (*e*) he founded a city, which implies that there must have been an already existing population. That the naked implications of the whole account are such as to warrant the hypothesis that there were numerous existing peoples who were strangers to Cain, and so who could not have been the descendants of his father Adam, we think is what no one can dispute.

There seems to be force in the argument from the Genesis account, but we must remember that the summary is very brief and leaves out much matter that, were it given, might make plain what is now obscure. The statement evidently implies that the Adam was the first man.

The usual effect of glamour is observable in the treatment of this case—the fascination of one set of new facts totally excludes or obscures all others. There are other facts than those startlingly arrayed to prove the high antiquity of man, which when considered, to say the least, point to his recency. These are as much entitled to fair consideration as those which are mustered with trumpets as settling the question.

We call attention to some of these, and commend them to the study of scientists and men who are eager to accept their theories.

And the first fact we name to them will surprise them and provoke a smile, a cynical, bitter smile, on the part of some of the *masters*, and a shamed and grieved look on the part of others—a fact which they seem to have forgotten, the fact that we have a book whose testimony has some bearing on the case.

We are mildly, and even pityingly, told that our witness has no standing in court. We beg to assure the attorneys on the other side that they cannot so easily get rid of our witness. He is before the court. He claims to be able to show by infallible proof that he is no less a witness than God himself. There are several things to be done before he can be so summarily dismissed. The case cannot be tried without him, or until he is shown to be unworthy of credit. It will not do to say that the facts are against him, and prove him to be unworthy of credit. That is the thing to be proved; but, before that is proposed, it will be well to inquire into the proof of the identity and competence of the witness. This will determine whether he should be ruled out or not.

The attorneys on the other side smile. A smile is not conclusive. They curl the lip in scorn, and even wax wrathful. They tell us it is preposterous; that it is only an old book, long since antiquated by the magnificent march of intellect; that the age has outgrown its senile stories; that it belongs to the museums. We beg to assure them that their eloquence and great learning are lost. The book must be heard. A book in itself proves nothing. It is a question of authorship. Who is the author of our old book? Everything depends on the answer to that question. No settlement of the question under consideration can be final without the settlement of that question. That will determine whether the witness is competent and whether his testimony ought to have weight against the witnesses introduced by the other side. They also are books; it will after all turn upon books.

Our book claims to be the testimony of God directly on the point in issue. You smile. A smile proves nothing. If it should turn out that it is God's book of testimony, the court will at least wait before it allows Mr. —— and Mr. —— and Mr. —— to scourge him from the bar without a hearing. They are highly respectable names, but they can scarcely be so much more competent than the Maker of the universe himself as with a few flint knives to send him in disgrace from the witness stand. Even the kitchen middens will not absolutely determine the case against him.

It is sometimes not easy to settle the authorship of a book. In this case it is not difficult. Again a derisive smile. It proves nothing. The evidence is irresistible. Will the doubters be reasonable enough to examine the case? We are sure that the study will make them wiser men, and somewhat lower their tone.

The real question here is this: "What is the comparative strength of evidence that the Bible is a divine testimony on

the subject in hand, and the evidence of facts alleged to contradict its testimony?" On that point we affirm that the proof in support of the biblical claim is immeasurably stronger—that, in fact, it is irresistible. We are willing to stake all on that single issue, and finally that issue must determine it. The Bible does not fix an exact chronology, yet no defender of its veraciousness will allow for it more than possible gaps of two to four thousand years. The time of man on the earth must fall within that limit or his history be resolved into a mere myth.

The evidence alleged for a longer period, and which if admitted invalidates the Bible statement, we affirm has no comparable strength to that which attests the worthiness of the revealed witness.

The testimony of facts is the strongest of all testimony. That is admitted. It overrides all theories, all inductions, all verbal testimonies. It is simply what are the facts, and what do they testify to.

There are two sets of facts here. One is the fact of a book which furnishes absolute proof that it is inspired. This fact is not a fact which is established by the senses, like the existence of a fossil or a stone ax, but it is nevertheless a fact which is supported by evidence as conclusive as that of sense. We present it as a fact, and on the validation of that stake the issue.

Now this inspired witness declares directly, not in terms, but in serial statements which necessarily determine proximate periods of time, that man has not existed more than from six to ten thousand years on the globe. No pretense will be set up against this amount. If this can be disposed of, it disproves the Bible. The evidence which can disprove it must be stronger than that which supports the inspirational character of the sacred book.

What is that stronger proof which carries the age of man up to one hundred thousand or one million years? It is a set of facts. What are the facts? We have just cited them. There are none others. The most diligent search carried on for scores of years fails to add a single item.

Concerning these facts, while we do not dispute one of them, we aver that most of them are strained in the statement, and lack the fullness of proof which is essential to enable us to judge of them simply as facts; to enable us to judge, we must be brought into more accurate relation to them. There is a witness between them and us that, without challenging or discrediting, we are not entirely certain is free from bias. It is not enough to bring the fossil or other fact alleged to exist. The environment is more important.

The facts do not prove what they are alleged to prove. They say nothing on that subject. All that is inference. Allow all the facts, the utmost they can do is to prove that man existed. They say not a word about the time when. That must be deduced. The question remains, What are the grounds of determination? We are told that the facts point to a time long past. How long? One hundred thousand years. We deny. What shall decide the issue? The facts do not decide it. They affirm nothing; they bear no date; they utter no word. Another set of facts are called on to do what? To help the first fact. Do they do what they are expected to do? We affirm that they do not. They form the basis of a probable conclusion, possibly—possibly not even so much as that. The induction is from very uncertain premises as to the facts, but they are put in no uncertain terms. For example, a human bone is found in a cave in Belgium, in a miscellaneous mass of bones of animals extinct before the tertiary; *ergo*, man lived at that time; the tertiary was certainly not more recent than one hundred thousand or one million years ago; *ergo*, man has

been on the earth one hundred thousand or one million years at least. *Ab uno disce omnes.* Now in all such statements there is not a particle of proof in support of the conclusion. It has no other weight than bold assumption.

What is needed is absolute proof, first, of the bone, that it is human ; second, that the accumulation has existed for one hundred thousand years or one million ; third, that this particular bone has been there for that length of time. The most plausible ground of inference only proves a plausible inference. There might be a thousand facts against it. Inference is not proof unless it is absolutely necessary induction from premises necessarily true. There is not a single case of this kind. The cases alleged, when weighed against other grounds of inference, dwindle into insignificance. Bold assumption is all that remains, and on this alone the Bible is brushed away as a fable. Reduced to its ultimate it reads thus: Somebody has found a flint knife, which evidently some man made, and it was in a place that shows that it must have been put there one hundred thousand years ago ; *ergo*, the Bible is a fable.

We beg to submit for consideration some other facts, which possibly will put an entirely new phase upon the question at issue.

Of the relative recency of man's origin there is no dispute ; not even the most bigoted opposers attempt to deny it. His place is accorded him as the last in the series of organic existences. It is further admitted that any signs of his existence are not found below the superficial deposits. It is also further admitted that any but the most crude memorials of him cannot be traced behind a few thousand years, and these were mere implements of stone manufacture necessary to his subsistence.

Has it ever occurred to those who contend for his high antiquity to explain how it was that he remained for so many

thousand years, as they allege, in so low a state of civilization that a few flint knives and other tools were all that he achieved, and that he so suddenly sprang into such marvelous development?

Two thousand years, or at most three hundred more, find the man of Europe a barbarian, sink even Greece into semibarbaric night. Not more than fifteen hundred more shut down upon the earlier hints of Assyrian and Egyptian rise out of barbaric conditions. All behind shroud the whole earth in utter night.

Can any man who has studied the nature of man believe that a hundred thousand years, or a half score of thousands of years, were passed by our human ancestors with such faint signs of intelligence? Is it like man as we know him? Would no genius have arisen during all those tedious millenniads to start a better era? Is it conceivable that no histories or traditions would have reached our time of so immense a period? What kind of man was it? Dr. Winchell and McCausland, by stress of necessity, admit that the man of those remote ages was not man as we find him, but a creature of intelligence just above that of the brute world—an unspiritual and irresponsible being. They admit that the Adamic man is a higher type of the *genus homo*, and that there is no evidence that this spiritualized humanity dates back beyond the time assigned by Moses.

Were these preadamites, then, men in any proper sense of the word? They lived, it is alleged, for one hundred thousand years without showing any sign of properly human attributes or character, without so much as showing an ethical or responsible condition. Could man as we find him have such a history—men without mind, without ethical ideas?

What became of these prehistoric men? They are alleged to be the Negroes and Mongols and their congeners. But are we to forget that a flood swept off the whole race except the ark family? Then these races now living cannot be the prehistoric

men. There are none of these now living. The Adam family are the only ones who come to us through Noah.

And what of population? Man is a fecund animal. Within the past four thousand years he has built civilizations, empires, cities, and peopled the world. There are no evidences that four thousand years ago, or even then, there were or ever had been forty million people on the earth. I will be bold enough to affirm that there is no evidence that there was ever half that number. Does this mean nothing?

Are we referred to the antiquities? Have you ever thought how meager they are? Were all the antiquities of the world behind a few thousand years gathered together, even including those which come so near us as back of two thousand years ago, including all the works of man that have perished, all products of every kind, they would not represent what England alone has done since the Anglo-Saxon dynasty arose, in less than a thousand years; and not one of these boasted antiquities can make out a claim of higher age than four thousand years.

The Chinese wall, the Pyramids, and a few others are often referred to. No one disputes that they are wonderful specimens of barbaric achievement at an early date, pointing to the crudeness of the civilization which produced them—monuments of the desire of people to perpetuate their achievements in building into them all their force. The Brooklyn Bridge alone means more than all the accumulated works of man up to less than a thousand, or even a hundred, years ago.

A hundred thousand years before man attained to anything beyond a flint knife! Who, upon the flimsy facts adduced, can believe that such has been human history? No; it is a travesty of common sense, a grim play upon the credulity of the age, a proof that any merest assumption will find leaders,

who assume great titles and constituents, who will eagerly swallow their bait, while common sense is silenced by their clamor. It is such things that disgrace the name of science. In its worthy representations we honor it, but even its princes constantly bedrabble their imperial robes.

Not a single fact has been adduced, nor can be adduced from any source, that warrants an extension of human chronology beyond six or eight thousand years.

Europe over three quarters of its surface falls within two thousand years, despite the kitchen middens. America gives no sign of a human inhabitant that necessarily carries the date up to half that time. Asia and Africa extend the period to twice that, and then plunge into prehistoric darkness, except for the light which shines from the sacred pages.

The question of population must be taken into account in determining the antiquity of man in the absence of reliable ascertainable dates.

We have seen how the degree of progress in civilized conditions bears on the question. Let us now consider the matter of population.

The evidence is conclusive that the race springs from one primitive stock; at least there are no facts which warrant a contrary conclusion, while many facts go to its support. It is also well established that the ethnic roots all center in western Asia. All known humanity is traceable to this region. These are important facts in their bearing on the question of antiquity. They circumscribe our search.

There is no law of humanity better understood and more firmly settled than the law of human propagation. It branches into several particulars:

First. Only man propagates man.

Second. Man, by an instinct as universal as the race, propagates as soon as maturity takes place, when not hindered or restrained.

Third. The child-bearing, or female, branch of the race is slightly more numerous than the male.

Fourth. The period of maternity is, on an average, between twenty and forty years, terminating at about fifty years of age.

Fifth. There is an average interval between offspring of about two years.

Sixth. A normal family under unrestrained conditions would be from six to ten children or more.

Seventh. Unrestrained, all men would be fathers and all women would be mothers, and restraint is never practiced except in highly civilized conditions. Savage man propagates like the beasts.

Eighth. About one half, or a larger proportion, of children born live to maturity in the common conditions of life, that is, when there are no special causes to prevent.

Ninth. There are about three generations in a century.

Tenth. Both maternal and paternal instinct prompt to the protection and preservation of the life of offspring.

A result of these well-known universal laws determines proximately what will be the population of the globe at any time from a fixed starting point, and the amount of population will indicate proximately the length of the line. There are many ways of testing this principle, and they will all be found to come to about the same conclusion, and will be attested by well-known history.

There are so many modifying circumstances that only a proximate result can be reached, but it will be of great significance.

If we fix the date of man's commencement on the globe at six, or not more than ten, thousand years ago, the time fixed by the most accredited biblical chronology, we have the following result. The chronology is not absolutely fixed, but it will allow of but little variation. It divides itself into two parts:

First. A period of sixteen hundred and fifty years before the flood, or possibly a few thousand years more.

Second. A period of forty-two hundred years since that event.

By the flood it alleges that the entire human race was swept away, except one family, who escaped the general destruction by the preparation of an ark, being forewarned of God of the approaching doom of the race. The saved family consisted of eight souls—Noah and his wife, their three sons, and their wives.

With the flood to help us, sweeping away all existing peoples but one family at the end of the first sixteen hundred and fifty years, and starting out anew with four mothers, we can get along, and with a liberal calculation for the ravages of death, so that only one in five of women born left two daughters to become mothers, we can place the offspring. Noah and Shem and Ham and Japheth, and their wives and offspring, and forty-two hundred years trouble us some, but we see a possibility of taking care of them; but when you require us to add one hundred thousand or one million years and three times as many generations, we are embarrassed with riches. The laws trouble us, and all known facts become unmanageable.

If we allow three generations for each century, we have in the time before the flood room for fifty generations. And if we allow of an increase of each generation equal to twice as much as the preceding, we would have this as the result: There is one mother to start with—the mother of the race; she becomes the mother of daughters, two of whom in turn become mothers, and this law continues throughout fifty genera-

tions. This would show the last generation, at the time of the flood, of women alone to consist of 1,066,107,210,237,184, that is, 666,317 times as much as the present population of the globe.

If now we vary the calculation and reduce the scale of fecundity so as that the rate of increase will only be double in two generations, we have this result: Twenty-five times the generation has doubled; the result would then show of women alone at the time of the flood 31,772,472. If we suppose an equal number of men, we should have as the gross population 63,544,944, swept away by the flood, having existed with their ancestors sixteen hundred and fifty years on a small section of Asia not more than a thousand miles square.

No one supposes any such population existed; but if we are required to extend the time, the difficulty becomes with every increase of time still greater.

When we think of sixteen hundred and fifty years as compared with the life of the planet, it signifies nothing; but when we think of it as a period in which human beings live and propagate their kind, it becomes vast and more than we know what to do with.

We are not now set for the defense of that account. Of its truth we have no doubt, for good and sufficient and easily assignable reasons; but that is not the task before us. Assuming it, we aim to point out that it will fully account for all known facts of man's inhabitation of the earth, and that viewed in the light of population merely it is self-verifying.

The ten facts I have referred to with respect to the law of human propagation warrant the conclusion that under favorable conditions the natural increase of the human family would be at least to double each generation, that is, that each mother would give birth to a sufficient number of female children to

leave at least two who should reach maturity and in turn become mothers. Some mothers would have but few children; some would have all sons, others have only daughters; some female offspring would prove infertile; but of the whole number it is a reasonable conclusion that under favorable conditions, with the instinct of maturity, the total outcome would not vary far from what has been above stated.

But now let us take up the second portion of time, that since the flood, when the race is assumed to have started anew. In this case we begin with four mothers, or four lines, and we have, instead of 1,650 years, 4,200 years since the flood; and instead of 50 generations, 141 generations. Our ark family start in the old cradle of the race—west central Asia. We have now the advantage that we are able to trace all existing races to about this ancient seat.

Our difficulty is not to account for all present peoples in so brief a time, but rather the time is more than we know what to do with. If we reduce the scale of increase, to double once in five generations, we have as the result 28 doublings. That would show the present population of the globe to be of each of four lines 254,179,775 of women alone. This sum, multiplied by four, the number of the lines would show 1,016,716,100; double this to account for the men, and we have for our present population 2,033,432,200—two thousand and thirty-three millions and nearly a half. That is at least 400,000,000 more than the existing population.

We persuade ourselves that we have made it appear in the preceding reasonings that there is preponderating evidence in support of the position (*a*) that man is an immediate creation and not a development from a lower type; (*b*) that he is a recent—the most recent—creation in the realm of terrestrial life; (*c*) that the entire race, with all its varieties, have descended from a single pair; and (*d*) that the radical distinction between

man and all other terrestrial types of life is that he is a spiritual being shrined in a material body; and, finally, (*e*) that he is the final cause of the creative movement, so far as the earth and the living races on it are concerned. His existence explains all previous stages of the creative drama.

All the study of the ages, replete as they are with rich discoveries, add nothing to the story of Moses, written nearly four thousand years ago, in the infancy of the race and long anterior to all modern learning and research; but while adding nothing, correction or contradiction, they do furnish abundant illustration and support of his statement.

ARE OTHER WORLDS INHABITED?

THAT the universe contains more than is reached by our limited means of information is probable, but of the unknown possibles it is vain to conjecture. Revelation intimates and in various ways affirms spheres and orders of existence rising in scale of dignity and excellence above man, and points to the fact that man himself is destined to a higher condition than he attains in the present life, and to transformations "from glory to glory" which will make his state and rank, if not radically different, yet extremely different in many respects. These are matters which do not enter into the discussion herein conducted.

What we have aimed to show are certain well-known facts of the universe, among which are: (*a*) that it is a made thing; (*b*) that it is of vast magnitude in space; (*c*) that it comprises four distinctly marked differentiations, inorganic, organic, sentient, and higher spiritual realms or orders of existence; (*d*) that it began in depths of time beyond computation in the creation of inorganic elements—atomic substances; (*e*) that by energizings in these inorganic substances world masses have been evolved of practically infinite number; (*f*) that these vast bodies by continuous energizing are maintained in their exact relations, harmonies, and motions over infinite spaces; (*g*) that when they had been brought by these continuous and wise energizings of the Creator, in vast eons of time, into proper conditions, life was introduced on the globe in all the varieties in which it has been and is found to exist; first, in vegetable varieties in successive epochs; second, in animal varieties of all kinds; third, in the man race, the crown and finish of the creative work in this world—and the most recent.

These facts we claim to be clearly ascertained and established by incontrovertible evidence. Whether there are other and higher races, or diversified races or individuals, in the immensity of worlds we now know to exist we have no absolute knowledge. It is a rational induction from what we know of what has been going on in our world for immeasurable ages, and from what we know of the great Being who has been carrying on the work in a way to denote his character, that a similar process is being carried forward in all completed world systems with characteristic variety and to worthy and noble ends. But it is one of the humbling reminders of our finiteness that we are so limited in our knowledge that even of our own world we know but scraps. Of all the million ages we are able but to gather up the scantiest hints. Of all those vast realms we are denied all knowledge except the scanty discovery that they exist and shine on seemingly forever and move over and in immeasurable depths in regulated harmony.

Do we reach the limit of our knowledge of the spiritual universe in the man race, or have we reliable information as to the existence of other spiritual races or orders? To this we are constrained to answer that we have no direct knowledge of any other order or races of spiritual beings than the human.

All spiritual beings, like their Creator, or, as he more properly styles himself, Father, are invisible, and come to knowledge only through acts which they are perceived to perform, or of which they are known to be the source—acts of intelligence—personal acts. We know of no such acts except such as are ascribable to God himself or to his human Child. Of any other orders we are not in position to know. But while we have no direct personal knowledge of such beings we are not wholly destitute of information of them. Revelation opens up an unseen universe to us, and there are many proofs that the information thus furnished is reliable.

As the telescope in one direction and the microscope in another serve to make us acquainted with vast regions of the material universe, which but for their aid, though lying immediately about us and cognizable by sense, we should not be able to know because of their distance or minuteness, so by revelation we become aware of a vast realm undiscerned by sense. Revelation puts a new object glass in our possession, and a new spiritual universe opens to our apprehension. The new lens serves the same purpose with respect to the unseen realm which the telescope and the microscope do with respect to the visible and tangible. We discover by the reason that the visible was made for the invisible.

We find it impossible, rationally, to doubt the veraciousness of the information thus furnished on two grounds:

First, on the ground of rational inference. The inference forces itself upon us in two ways: (*a*) There seems no adequate reason for the existence of the vast spread of the material universe—no reason for its creation even, if we remove the idea of service to a higher and nobler order of being; (*b*) many facts of our experience imply the influence of such beings among and upon us. This subject will be fully discussed in another volume.

Second, on the ground of explicit revelation. The evidence that we have a revelation is such that we are shut up to faith. This subject is fully treated in our third volume, *The Supernatural Book*, to which we refer the reader. On these grounds, while we have no direct personal knowledge of other created spiritual beings than those of our own race, we find it impossible to doubt that there are such.

The view opened by revelation gives infinite significance to the universe scheme. New meaning is imparted to every increment of the movement from the inception to the comple-

tion, or to each stage of a progress which will have no end. A vast spiritual empire rises upon the ancient foundations which is to last forever. The earlier forms, having served their ends in the various transformations through which they pass in almost infinite ages, will probably vanish, and "a new heaven and a new earth," or new and higher style of habitations prepared for more exalted ends, the habitations of advanced orders, will take their place (Rev. xxi–xxii).

Other races, or orders more properly—for we do not find that they are spoken of as having racial descent or origin—are named under various titles of eminence, as "thrones, dominions, principalities, powers, angels, messengers, spirits," and such like distinctions. Their activities and services are described and somewhat of their history intimated. They are uniformly referred to as of higher orders than that of our own race—more ancient and honorable in the trusts committed to them—elder brothers of larger growth. They are represented as of vast multitude—an innumerable host. How they attained their high estate is not intimated, whether by creation or by graduation through a worthy probationary history of loyal and faithful and long-continued service. All analogies would favor the latter view.

There are three principles discoverable in the spiritual universe plainly revealed, great ethical axioms: (*a*) all spirits are under strict ethical laws, consequently have a probational history; (*b*) growth in power is the law of their existence; (*c*) character wrought out in service is the determining ground of distinction among them, and so of destiny.

On these principles there is reason to suppose that the highest spirit in the empire of Jehovah has won his distinction by his loyalty of service.

When the inquiry emerges, What is the reason for the existence of the almost infinite array of worlds—the great material creations—that is, to what end and purpose do they exist? it cannot be answered either absolutely that they exist for no reason, nor yet even possibly for no reason. They are shown to be a product of intelligent power. The proof is positive. But intelligent power is not exerted without a reason or worthy end; its characteristic is that it proposes an end which is rational and worthy; otherwise it could not be worthy of an intelligence of high grade. In this case the cause is shown to be omnipotent and infinitely wise. The end to such a being must be not only an end, but it must in every case either be a most worthy end in itself or means to a most worthy end. Less than this could not be an adequate motive for creation. If it should be said that much that is found in the universe can have no possible reason for existence, or no reason of worthiness, either in itself or as means to worthy ends, we have to answer that this is an assumption too high for us, and of which no instance or proof can be alleged, and which in its very utterance is a blasphemous impeachment of God. We may not be able to see the reasons in every case, and, in fact, do not see the reason for anything as it lies before and in the infinite mind; but we must believe that there are adequate reasons for everything that can be traced to him as cause. In most cases we can, even with our imperfect understanding, detect something of what he must have felt and purposed—the motive that moved him to act. Are we able to detect any reason in this case, Why did he make these many worlds?

It must have been for some reason purely subjective to himself, or for some objective good to be realized through them that they exist. No other alternative can be conceived. What could be the conceivable good to himself?

If we suppose that there was no end to be served but his own

gratification the question emerges, What possible gratification could there be in such an aimless exercise of power? Can any motive to such a nature as we know God must possess be conceived? What of good of any kind could it give to him? And if it could give nothing of good, wherefore exert the power?

There could be no good to mere brute matter in its existence as cause thereof. To the question why it should exist, or exist in this form or that if it alone is to exist, no possible answer can be returned, because it is impossible to find an end of good in it which can be alleged as the why—no end of good to God, no end of good to itself. But if it could not exist without some reason, and the reasons cannot be found in God alone or in mere brute matter alone, the reason must be found in some other being or beings to whom it may be a good. If it should be said that all reasons for any creative acts must exist in God himself, we have to answer, the reasons why he should act, it is true, must be in himself; but there must be reasons, and they must respect a good of himself or other beings; and since we have seen that they cannot terminate in himself, they must respect other beings who have a good to be served.

If it were conceivable that his own glory is the sole motive it still remains that he cannot secure that without relating his act to some being who can see in it that which is good, and therefore to his glory, for that which is not a good and which serves no good cannot be to his glory. Thus it must make for some objective good in order that he may be glorified in it.

What, then, is that objective good? If we suppose that creation ministers good to other beings than God we have the question, What other beings?

If we assume that the earth alone is the theater of life, then the good must be to beings on the earth, for only crea-

tures that have life can be recipients of good. But then we have to find that all worlds do in some measure minister to the good of living creatures on the earth or they exist for no good.

Can this be shown as rationally deduced? We do not see how it is possible. We have seen how almost infinite the universe is. How can it rationally appear that any worlds are of any service to life on this globe but those which belong to the solar system? And of these what services are discernible except in the case of the solar center? If it should be assumed that the stars within our vision minister to man a good can we believe that any real service is rendered? And what of those sidereal heavens of which we know nothing at all? It must indeed be a great stretch of assumption and faith to suppose that the whole universe was created for any good it ministers to this planet. Is it a more reasonable supposition than to suppose that they were made to serve the purposes of life on their own surfaces? About five thousand stars can be seen by man. If these were all, it would be incredible that even these found their only reason for existence as objects of study and instruction to man or any good the life of the earth receives from them. But what shall be said of the millions which the telescope discloses to us, some of which are so distant that the very light which reveals them has to travel half a million years to reach us? Surely the motive for creating these must be found in a good to other life than that which is of the earth.

There may be worlds not yet fit for life, there may be worlds from which life has vanished; but it is not supposable that there are any worlds not in some way designed to minister to life at some time in their history. And as no life has a sufficient worthiness to make its existence an object except spiritual life, or that which sustains spiritual life, we may reasonably conclude that spiritual life either now does or ultimately will

overspread all worlds. The same law in essence which obtains here probably obtains throughout the universe.

If we allow this, and whether we allow it or not, what unimaginable magnificence is discernible in the divine plan! The universe is a theater of life in all gradations, from the mite whose structure is microscopic and whose history is limited to a transient ecstasy—a single moment to the archangel whose powers are almost godlike and whose rapturous history extends through eternity.

Conclusion.

In conclusion, let us for a moment endeavor to picture to our thought the ineffable movement from its inception to its culmination.

Résumé.

We pass in thought to a time when no world hung in the vast abyss—when no star sent out its solar light, when no planet revolved where the archaic fire-mist itself did not exist. No creative act as yet had been performed. In the vast and limitless solitude God dwelt alone. It transcends our comprehension; yet is that which, pushed by a necessity, we cannot resist, we are compelled to believe. The unoriginated, eternal, infinite alone with himself; yet not alone, for he was three. In his ineffable nature there was fellowship commensurate with its own infiniteness. There was "Father, Son, and Holy Ghost." We do not undertake to translate it; we accept it. It was not something made, not some subjective effect wrought upon or within his own personality and brought into his immutable consciousness; but rather it was of his essential being.

In him were consciously the seeds of all possibility, and there was no potentiality apart from him, and never could be. He with perfect wisdom discerned among possibles the best. That potential best he chose to make the real best. The universe is the result, as it is, as it has been, as it is to be. He determined the bounds and decreed the method of his

own energizing. He would take eternity to consummate his work; the plan should be worthy of his wisdom and its realization worthy of his power; and, what was the crown and glory of all, it should in everything be a perfect expression of his boundless love. In idea from base to finial it stood complete, a picture of matchless perfection. "Known unto him were all his works from the foundation of the world." It should start with its substructure in the dust, but its dome should be in the splendors of imperishable spiritual glory. He would begin by the creation of innumerable atomic stones—invisible, impalpable infinitesimals scattered broadcast over the limitless fields of space, which by an inherent law imparted in their creation should each and severally do his bidding, stone coming to stone, and by divine marriage forming indissoluble and definite unions. These complexes massed and segregated by a mysterious instinct or imparted energy should form into systems of worlds which, fixed in noninterfering orbits, should go revolving through the ages of time and extending over immeasurable fields of space. He would take vast time for the evolution; for to the Eternal time counts nothing—there is no sooner or later. Slowly, in imperceptible progress, the vast ideal should emerge into reality, from dim outlines and shadowy forms to solid worlds, and the sidereal magnificence should be complete. Thus he wrought until the material universe, the thing of beauty and grandeur that it is, stood a finished ideal, and "he pronounced it good."

But there was no life over its vast surfaces. That was its final cause; but the time was not yet. Its broad and generous breast was not prepared for the setting of that priceless jewel. It would come in many faceted beauty. The air and the water and soils should be full of it, and the great globes should yet thrill with its ecstasy. One almost suffocates as he thinks

back into and over those vast solitudes of azoic time and sees the patient worker building alone, with no eye to brighten or smile to approve or nerve to thrill at the contemplation of his work. But tireless and patient, and in joy, age following age, he built, built, built.

Finally came the age of life; and he commenced unrolling the wonders of vegetable fiber and fleshy tissue and the deeper wonder of sensibility as it appears in animal life. The display is practically infinite, filling the gamut of possible organic varieties from spore of algæ to the mammoth trees of the Calaveras forest, from animalcule to mastodon. How infinite the ingenuity! How impenetrable the mystery! We can never fathom it. How the eternal Spirit worked and does work in translating himself into varied forms of materiality and life eludes us; but the fact of the universe is proof that he was able to do so.

Standing at the base and looking upward from the fire-mist through long vistas of formative ages until the chaos burst into sidereal splendor, and from the first quiver of life through the ever-ascending series until it culminates in man, and then through successive stages of spiritual development until it issues in an innumerable host of deathless and exultant spirits who know and worship their Maker, and on to the vision of their ever-growing happiness and perfection, we are lost in wonder and praise. Such is the vision of God's plan and method which revelation opens to us, and which all the facts known fully corroborate. If there are evils they are but limited and transient incidents which sink out of sight and disappear as we gaze upon the eternal brightness.

If we reject this view, or some view substantially agreeing with it, what are the alternatives? We must either deny that

there is any plan or substitute one that is inferior, and with no better grounds.

The former is sheer *atheism*. Does it lessen the difficulties? Is it easier, and more in accord with our intelligence, to conceive and believe that the universe came into the orderly state in which we find it, without the agency of a guiding mind, or with it? Can we believe that such a system could spring from mere chance? It is possible to assert it; but could there be a higher proof of irrationality than the belief of it? If we could assert that the universe evinces no mind, without forfeiting the reputation for intelligence, what could we assert that would forfeit it? Surely there is no escape in this direction. We are shut up either to the belief of an intelligent and purposing cause or, in the denial of it, to a conclusion which writes us down as irrational.

But, admitting that it is a product of mind acting to an end, we must either accept some such plan as that indicated or one greatly inferior. Why take the alternative? Can better reasons be alleged in support of any inferior plan? Does the exclusion of the idea of a spiritual world relieve the problem? Is it more rational to attribute mental phenomena to molecular activity than to believe there is a spirit in man or that man is a spirit? Is the problem simplified by denying spiritual existence?

But if there be spiritual existence, why limit it to this world? If it is the great ultimate fact here, why suppose it is not the great ultimate fact in other worlds? Why put an inferior ultimate in its place when there is no assignable reason for doing so? If life and spirit were but an accident here we might indeed reason that it was probably exceptional, as there is good reason for believing that mere chance does not repeat itself; but when we find intelligence moving to a highest end in a given case, and so indicating its own idea of fitness, on what principle can

we substitute an inferior end in millions of other cases? If a world can be made to support life and spirit as it is found in the case of this world, and if such a use is most worthy and honorable and most coincides with the wisdom and goodness of God; if it is a higher work and seems a higher end than a mere globe of matter without life and mind, why suppose that in one case the highest is aimed at and reached, and in a million million cases it is not purposed at all, and that which is purposed in the plan is no worthy end at all?

What we claim, and all that we claim, is that the universe is in the interests of a good, and that any good must in some way relate itself to life, and that the highest good must relate itself to mind. We do not claim that all worlds must necessarily, at any time, be the abode of material life. They may in other ways serve the interests of life than in furnishing the dwelling place of living beings in or out of bodies; but we do hold that it is highly probable that solar centers do in every case probably furnish the conditions of material life at some time in their history, and that they were probably made to that end; that so the entire field of the universe is at some time the birthplace of life, and life in its highest type; and that the probable ultimate end of all is the occupancy forever of a boundless spiritual and immortal population, who shall exist in such forms of life as to enable them to intercommunicate with freedom, and derive happiness from mutual service and fellowship.

If we were asked the ultimate of God's plans we should answer, it is to raise up a boundless holy population of spiritual beings who shall constitute his family, having his universe for their home and his love for their dower, and who shall progress forever and ever in knowledge and holy happiness. Such is the universe as we find it, a vast and almost infinite scheme

of worlds spreading abroad over semiinfinite space and time, regulated and administered with infinite wisdom and love, for an infinitely worthy end.

Beginning with the atoms, the Author, it is shown, for some reason occupied vast measures of time in constructing them into world systems. Of this the proof is complete. Then in equally great reaches he employed himself in creating in succession advancing orders of organic existences—living races. Of this the proof is likewise complete. The first types were insensate and of immense variety, growing directly from the prepared elements of the earth. The second type, conditioned by the first, took on the higher quality of sensitivity and seeming semimentality in varying degrees. The different kinds were fixed and also of infinite variety. This also is established beyond dispute. These of both kinds, sensate and insensate, were alike subject to the law of decay and death. Not only the individuals, but races perished, to be followed by higher races. This also is established beyond dispute. During all this period—a semieternity, almost—there is no evidence that an intelligent or ethical being—a single person—was found in all the universe except the Creator alone. If anything in the history of the universe is established these things are.

Finally, at the end of almost interminable ages, man appeared as the last of the series, at a period which is so recent as certainly not to exceed a few thousand years. All admit his recency and the fact that he is the end of the series, but some on inadequate evidence, as we have seen, push the date of his arrival back to a more distant point.

As we trace the movement over immeasurable ages the thoughtful mind cannot fail to be impressed with its majesty. Each new stage is conditioned by, and rises upon the platform

of, that which immediately preceded; but while there is a strict chain of connection from the beginning to the end, that which precedes is never the cause of that which follows, but only the conditioning antecedent.

By these long processes we are brought to the universe as we find it to-day. Man is the difficult problem in the universe system. A future volume will treat of him more specifically.

Well did Brewster, in *More Worlds than One*, in substance say:

Those impulsive minds that can be brought to believe that the earth is the only inhabited body in the universe, will have no difficulty in conceiving that *it* also might have been without inhabitants. They must admit that for millions of years it was without inhabitants; and hence we are led to the extraordinary result *that for millions of years there was not an intelligent creature in the vast dominions of the universal King, and that before the formation of the protozoic strata there was neither a plant nor an animal throughout the infinity of space.* During this long period of universal death, when Nature herself was asleep, the sun with his magnificent attendants, the planets with their faithful satellites, the stars in the celestial systems, the solar system itself, were performing their daily, their annual, and their secular movements, unknown, unheeded, and fulfilling no purpose that human reason can conceive, lamps lighting nothing, fires heating nothing, water quenching nothing, clouds screening nothing, breezes fanning nothing, and everything created, mountain and valley, hill and dale, earth and ocean all meaning nothing.

To our apprehension such a condition of the earth, of the solar system, and of the sidereal universe, would be the same as that of our own globe, if all its ships of trade and of commerce were traversing its seas with empty cabins and freightless holds —as if all the railways on its surface were in full activity with-

out passengers and power—and all our machinery heating the air and gnashing their iron teeth without work performed. A house without tenants, a city without citizens, presents to our mind the same idea as a planet without life and a universe without inhabitants. Why the house was built, why the city was founded, why the planet was made, and why the universe was created it would be difficult even to conjecture. Equally great would be the difficulty were the planets shapeless lumps of matter poised in ether and still and motionless as the grave; but when we consider them as chiseled spheres teeming with inorganic beauty and in full mechanical activity, performing their appointed motions with such miraculous precision that their days and their years never err a second of time in a hundred centuries, the difficulty of believing them to be without life is, if possible, immeasurably increased. To conceive any one material globe, whether a gigantic cloud slumbering in space or a noble planet equipped like our own and duly performing its appointed task, to have no living occupants, or not in a state of preparation to receive them, seems to us one of those notions which could be harbored only in an ill-educated and ill-regulated mind, a mind without faith and without hope. But to conceive a whole universe of moving and revolving worlds in such a category indicates, in our apprehension, a mind dead to reason and shorn of feeling. With such truths before us is it possible to believe that, with the exception of our little planet, all the other planets of the system, all the hundreds of comets, all the systems of the universe, *are to our reason made in vain?* It is doubtless possible that the almighty Architect of the universe may have had other objects in view, incomprehensible by us, than that of supporting animal and vegetable life in these magnificent spheres; but as the question we are discussing is one in which we can appeal only to human reason, and as human reason in its highest form cannot discover these

other objects, we, the inhabitants of one of the least of these spheres which has for immeasurable periods of time been preparing for the residence of man, must believe, under the guidance of that reason, that they were destined *certainly*, like our earth, for an intellectual race, and destined *probably* for a previous and lengthened occupation by plants and animals, in order that their inhabitants may study on the tombstones of the past their miraculous processes of growth and decay, of destruction and renovation, by which there has been provided for them so noble an inheritance.

Well, also, does Dr. Bently, in *Origin and Frame of the World*, say:

"But we dare not undertake to show what advantage is brought to us by these innumerable stars in the galaxy and other parts of the firmament not discernible by naked eyes, and yet each many thousand times bigger than the whole body of the earth. If you say they beget in us great ideas and veneration of the almighty Author and Governor of such stupendous bodies, and excite and elevate our minds to his adoration and praise, you say very truly and well. But would it not raise in us higher apprehension of the infinite majesty and boundless beneficence of God to suppose that these remote and vast bodies were formed not merely on our account, to be peeped at through an optic glass, but for different ends and nobler purposes? And yet who will deny but there are great multitudes of stars beyond even the reach of the best telescope, and that every visible star may have *opaque planets* revolving about them which we cannot discover? Now, if they were not created for our sakes, it is certain and evident they were not made for their own, for matter has no life nor perception, is not conscious of its own existence nor capable of happiness. We give the sacrifice of praise and worship to the Author of its being. It remains, therefore, that all bodies were formed for

the sake of intelligent minds, and as the earth was principally designed for the being and scenic contemplation of men, why may not all other planets be created for like uses, each for their own inhabitants which have life and understanding?"

Who that has gone with us through this inadequate survey of the wonders of creation, imperfect as it has been, or who that gives himself to the study of the great theme, has failed to be impressed with the stupendousness of the great work and the greater marvelousness of the mighty Worker? We see but parts of his ways—the smaller part; the vaster part lies hidden in the depths of eternity. The millions of years that have passed in review show us the beginnings; when millions of ages have passed we shall still be but in the midst of a progress that knows no end, and as ages on ages roll away it will still continue to unfold. The mystery and majesty deepens and widens as we advance. Overwhelmed with the vision we adoringly join with the anthem which comes rolling down from eternity: "The song of Moses the servant of God, and the song of the Lamb, saying, Great and marvelous are thy works, Lord God Almighty; just and true are thy ways, thou King of saints." From millions of millions of thrones eternity echoes and reechoes the exultant Amen and Amen; the Lord God omnipotent reigneth: to him be glory and might and dominion forever and ever. Amen and Amen.

CONCLUSION.

IN closing the discussion conducted in this treatise we are free to admit that the subject, in all its parts, is one which is shrouded in exceeding obscurity; without superhuman aid, perhaps absolutely inscrutable; but with such help to set our investigations in the right direction, not impossible of rational solution.

Revelation furnishes us the well-authenticated and perfectly competent key. It puts us in possession of the testimony of the great Author himself. Its statement is clear and rational. All the researches of science, conducted by educated mind, up to date fail to furnish a single well-established fact in contradiction of its teaching; while they more and more, in proportion as their conclusions are increasingly reliable, become rich in confirmatory evidence of its fundamental principles and general historic details. This indisputable fact is of wonderful significance. The God of the Bible is demonstration of the divinity of its origin. The amazing travesties of all competing systems, ancient and modern, are proof irresistible that it is not a man-made book. The earliest, it is also the safest, the only safe guide.

When we open the sacred pages it is as the rising of the sun alike on the obscurity of the past and the deep mystery of the future. The entire mystery of time past, and to come, becomes illuminated. It gives us not simply the Author, but the why and the method of the divine movement from the beginning; also its progressive stages through interminable ages—through eternity itself. Out and away from the material universe it opens to us richer and more glorious unseen heavens, peopled

with hosts of races and orders, kindred to but older and more glorious than our own. It discloses the fact that our brief terrene history is but the dawn to an immortal day; that we, despite the humiliations of the present state, are possible heirs "to an inheritance incorruptible, and undefiled, and that fadeth not away." In its light the universe becomes worthy of its eternal Author. The infinite array of worlds is no more mere garnishings; they are transformed into homes in the many-mansioned house of the heavenly Father.

Mystery still hangs heavy around the horizon of the utmost reaches of our finite thought, but it is only the mystery which must forever attend the finite in its attempts to measure and comprehend the Infinite in his measureless plans and method —mystery dark with excessive brightness, not entirely relieved, but irradiated with the comforting beams of hope and rational faith. We do not fully comprehend, or even clearly apprehend, the outcome, but we do see enough to beget in us assurance of its beneficence and transcendent glory; a glory that will not merely relieve, but make luminous, all incidental darkness along the line of its progress. There is nothing grotesque in its statements, properly interpreted. In all, and through all the great Author is seen to be working to an end worthy of his infinite perfections. We shall finally see that what seemed to us the most meaningless parts were full of great meanings, and that those parts which at one time seemed harsh, and even cruel, were necessary incidents of a most perfect and beneficent plan.

Far on, when the transient, having accomplished its end, shall be superseded and pass away in some manner incomprehensible to us now, we shall find that what remains and abides forever will justify and glorify the whole process. Of this we have the most assured faith, based on what is and has been. What will be the methods and measures of future revelations we do not know or even dimly apprehend; but what we know

not now we shall know hereafter. This is the promise; it will not fail.

Our own nature, which is doubtless analogous to the nature of other races and orders in other worlds, but with varied experiences, suggests something—much. It is of great significance that all these suggestions are in harmony with the glimmering out-givings of the sacred book. We must wait for fuller knowledge of ourselves before we attempt the interpretation of all the possibilites within us and the ripe and full destiny before us, assured, meanwhile, of so much, that it will surpass all our hopes and longings.

God is; that is enough. The universe proclaims his power and majesty, and, more comforting still, his love. It is safe and sweet to trust him. Nothing has been discovered that awakens in us the slightest distrust.

There is, we know, a dark valley to pass where all earthly lights are extinguished. Into it all our kindred have gone; none have ever returned. Unbroken silence broods over its dreaded secrets. To mere sense it is an abrupt boundary. Into it we ourselves shall soon enter. It looks chill and gloomy, its portals forbidding. Unsupported our nature shrinks from its approach. Its spectral horrors, the gloomy progeny of imagination, make us afraid. Its silence appalls us. So it is to sense. Rational faith is assuring. Revelation comes to our rescue. It kindles a pharos on the further shore. It tells us of One who is master of this gloomy realm, who will meet us at its portal and guide us through its gloom, and bring us to our loved ones who have passed on before us.

There is a throne of judgment; our conscience tells us of it. Our sins make us quail with terror at the thought of it. We are conscious that we cannot endure its searching light; not the

best of us. Eternity hangs on the decisions of that dreaded tribunal. Again revelation comes to our rescue. It lifts the curtain, and lo! our Brother sits upon the judgment seat.

Love and mercy hold the balance. Eternity's morning opens propitiously to every trusting soul. The lamps of our limited knowledge go out, but the darkness is not total. There is a glimmering ray in every soul. Revelation lights up the valley and shadow of death.

As all kinds of being, spiritual and material alike, depend for the beginning of their existence and all modifications of their form and modes of activity on results of divine energizings thereto, and as the divine resources are inexhaustible, it is impossible to us ever to know what varieties may exist in the immensity of worlds at any time, and especially what varieties may yet appear in the endless future. New worlds may be created and worn-out systems be endlessly renewed and transformed, on whose surfaces varied and higher types of life may successively emerge. These are points on which revelation is reticent, and upon which reason reaches no data from which to draw assured conclusions, or any conclusions other than the general inference that the great Being who has commenced to work will continue, in such manner as seems good to himself to energize forever and ever, in a way that will glorify his infinite perfections.

With respect to the moral universe, which we know to be the final cause of all divine activity, and whose interest must forever be supreme, we know that its great principles and laws are immutable; and the same for all worlds and all orders, however the components may vary in historic incidents and personal accomplishments.

Among the unchangeable laws are these: personal qualities determine destiny—character, resulting from free self-deter-

mination, fixes rank and condition; what individuals become is dependent on their own election and conduct—whether they will ascend or descend, dwell in the heavens or in the hells. This is a first and changeless law.

A second law is that of possible personal growth from zero of beginnings to unlimited greatnesses of power and dignities and worthinesses. This law we detect in the nature of the moral and intellectual faculties and powers. No great thinker calls in question this law or the destiny to which it points. The universe of that far-off age, composed of high ranges of half an eternity's growth, may differ from the universe of to-day as the infant differs from the man, or rather from the angelic final man.

Unselfishness is discerned as a third law—the all-embracing law of the moral universe system, binding alike the throne and the footstool, the great King and every individual subject. The perfection of holiness is complete conformity to that law. Ministering to the good of others is the immutable requirement, and conformity the ground and condition of individual destiny. The varied ranks and orders, and each individual composing them, in some way at present unknown to us, will find spheres as they advance for holy endeavor in which they will find their ecstasy of life. How one immortal being is available to the service of another—what the method of their intercommunication and fellowship—we must die to understand; but that there is a way we find it impossible to doubt. Eternal growth in power, eternal ministries of love over immeasurable realms of the great King, as we see it, is the glorious consummation of the moral universe system.

It is not matter of conjecture or mere speculation in the light of these laws that the universe of to-day is not identical

with the universe of the yesterday of the long-vanished millions of ages ago; it is among the most certain of our knowledges. Chaos has become cosmos. We are warranted in the inference as a rational induction, and not merely an imagination, that the universe of the great to-morrow will not be the same as the cosmos of to-day. Much that is will vanish; some things undergoing transformation will be carried up; but in many ways much will be added. Evolution following evolution will add increasing splendor to the glory of divine thought. The new heaven and the new earth of the material realm of the coming time may not be more magnificent than the stellar dome of to-day; or possibly even here there may be a change from glory to glory. Progress there has been; it may not have reached its climax, either in its scope, vast as it is, or in its beauty and adaptations. The infinite has inexhaustible resources, and we may well rest assured that there will be no want or lack of completeness.

When we turn our attention to the moral system, the induction is warranted that here there will be vast changes in all the incidents and conditions of personal character and experiences, changes of relation to the material, changes of personal qualities and modes and spheres of action, changes which will make the universe yet to be infinitely more glorious than that which was in the beginning, and more wonderful than that which now is—increasingly more glorious forever and ever.

That this will be so is not merely a hope begotten of divine assurances contained in the great book given us for our guide and encouragement, but warranted by the nature of spiritual mind as we know it in our self-conscious personality in the great law of continuous growth and progress. When millions of years of experience and growth of power have built themselves into the

tissues of our being, and into the substance of our knowledge, and into the solidification of our character—millions of years of companionship with other great spirits, and fellowships, and intimacies with God himself, and into active participation in the ministries of love and usefulness of service which await us—though we shall be in some respects the same beings that were once infantile and at zero of power and attainment, we shall yet be, in all respects of quality and worthiness, a different kind of beings from what we now are. The whole universe will thus grow in dignity and glory as the ages pass away.

This is the true evolution. The vision which rises to the view of the thoughtful mind, as we seek to penetrate the to-morrow of our deathless being, is too dazzling for our gaze. When it arrives a corresponding growth of our powers will fit us for its bright revelations and experiences and great endeavors.

What has been, and what is, is the promise and prophecy of all that will be. We do not discern the outcome, but we do discern the trend. The outcome cannot fail to be more glorious than our power of thought is able to conceive.

Lapse of ages of time may bring nothing new to a universe composed of atoms, but in the realm of mind and spiritual powers lapse of time means progress—advance. When we see the growth of a few years in individual souls, and of a small number of centuries in the development of a race, what must be the possibilities of millions of ages? The evidence is that we are in the beginnings; incomputable milliniads await us. The evidence is that infinite power and wisdom and love have initiated the movement. What has been done is a hint. When we cast our gaze in the direction of the pointing, and remember that eternity lies open for the unfoldings, who can calculate the possibilities?

It is God's universe. It will be what he chooses to make it. He has an end in view. He will not fail to reach it. The progress will be, as it has been, from glory to glory. Each succeeding generation here standing on the shoulders of its predecessor, and entering into its wealth of inheritances, will advance to improved conditions, and will carry forward an increasingly benignant civilization, made more beautiful by improved knowledge and increase of wealth, and toned and tempered by the presence and power of a divine religion, until the horrors of heathenism and ignorance and wickedness will be driven away, and the earth itself will be radiant and happy. The kingdoms of this world will become the kingdom of our Lord, and of his Christ; not to-day, but in the relatively near to-morrow. It will be born again. All events point to it and hasten the coming morning.

But the highest glory of the universe lies beyond the grave, in the final great evolution—the enthronement of the spiritual. There lie the great growths, the ineffable transformations, the final outcomes. Of that Nature says little, science is dumb, but revelation is full of adumbration and promises. "And there shall be no more death, neither sorrow, nor crying, neither shall there be any more pain: for the former things [will be] passed away," and unimpeded progress will continue forever and ever. It is God's universe, and such is God's promise. What shall hinder? Eye doth not see it, neither doth it enter into the heart of man to conceive it, but there is abundant ground for rational faith to rest assured of its realization.

Here we rest. No man taketh from us this consolation. Death itself is shorn of its terror. The grave becomes the shining portal of the everlasting home.

THE END.